Win a Minolta Camera

Computing Now!

Canada's Personal Computing Magazine

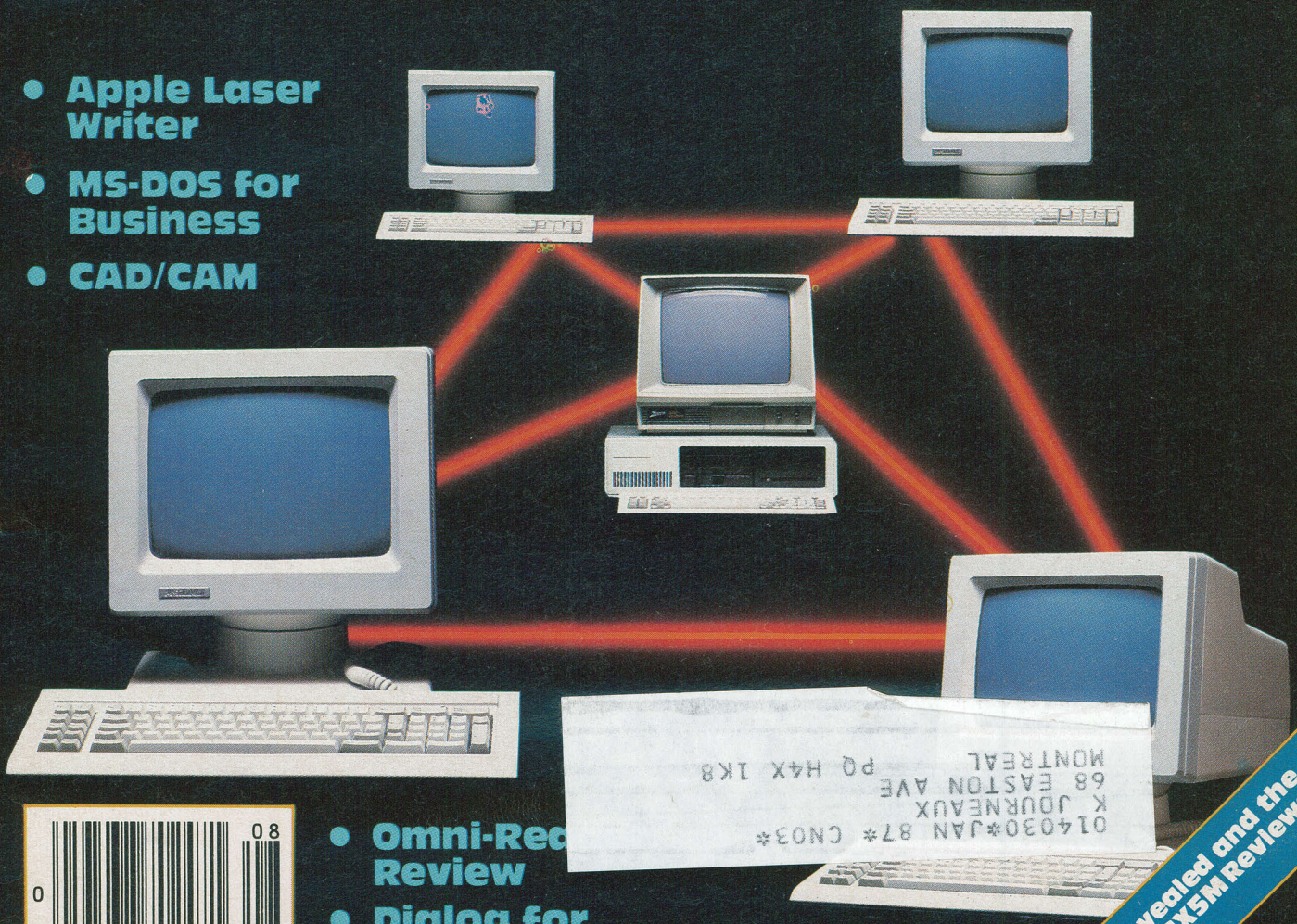
August 1985

$3.25
MM70247

Local Area Networks in Business

The technology becomes affordable

- Apple Laser Writer
- MS-DOS for Business
- CAD/CAM



- Omni-Rec Review
- Dialog for the PC

MSX Revealed and the Yamaha CX5M Reviewed

The BEST MK II Super PC and XT Compatibility

Look what you get as standard!

- Uses 8088 microprocessor.
- New Feature, 256K RAM as standard.
- New Feature. Comes with the latest 41256 RAM chips.
- Expandable up to 512K and more on main board using 41256 RAM chips.
- New Feature. 7 expansion slots, each being identical for the user to upgrade as required.
- New Feature. Fitted with 150W power supply so system can be upgraded to a hard disk without changing power supply.
- New Feature. Flip-Top case.
- DMA controller. Three of the DMA channels are available to the user.
- New Feature. Even most basic versions come with Parallel and Serial Ports and Real Time Clock.
- Half watt speaker.
- Pre-socketed for optional coprocessors such as the 8087 math processor.
- Keyboard interface compatible with IBM compatible keyboards through a 5-pin DIN connector.
- Three ROM sockets are available to the user, one generally holding the Phoenix BIOS.
- New Feature. Reset switch.
- Timer/Counter used by the system for Real Time Clock, time base and for tone generation.
- Complete with the Phoenix BIOS, identical to that used by many of the large US companies manufacturing IBM compatible computers.
- Comes with two Slimline DS, DD 5¼" 360K Disk Drives.
- Colour Video (RGB and composite) and Disk Controller cards included.
- 230V models available.
- 300 Day warranty.

Tape Drive option backup suitable for all systems . . . . . $Call

IBM is registered trademark of IBM Canada Ltd.

The BEST Mark II

As described above using 41256 RAM chips. Two 360K DS, DD disk drives, RS232 and parallel port, Real Time Clock, 7 slots, Phoenix BIOS, Colour Video and Disk Controller Cards, Keyboard and much, much more

With 256K $1695 **With 512K $1795**

The BEST 10 Meg Hard Drive

As the BEST Mark II but with 10 Meg Hard drive (supplied with one Floppy Drive. For second drive add $200).

With 256K $2695 **With 512K $2795**

The BEST 20 Meg Hard Drive

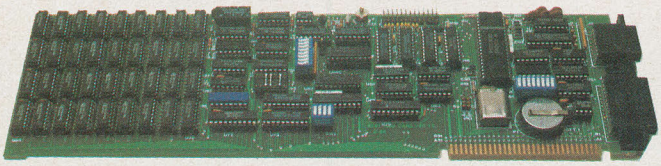
As the BEST Mark II but with 20 Meg Hard drive (supplied with one Floppy Drive. For second drive add $200).

With 256K $2995 **With 512K $3095**

Also the Basic BEST $1595.00

As the BEST Mark II described above but without Parallel Port or Real Time Clock

The Best 256K PENTARAM BEST SELLER



$299.00 with 256K RAM, Real Time Clock Parallel, serial and Game Port.

New Multifunction Floppy Controller for your IBM or Compatible.

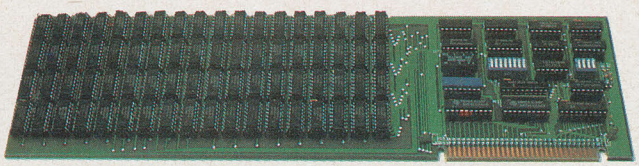
Includes: Floppy Controller (up to 4 DS, DD drives) Parallel Port, Real Time Clock/Calendar (with battery backup) and 2 Serial Ports (of which only one is installed, the second is an optional extra at $29.00) **$199.00**
(Real Time Clock software is included — cables are extra)

Parallel/Game Port (For IBM or Compatible) . . . . . **$79.00** (cables extra)

Quanta Board with Parallel and Game Port, 2 Serial Ports and Real Time Clock . . . . . **$159.00** (cables extra)

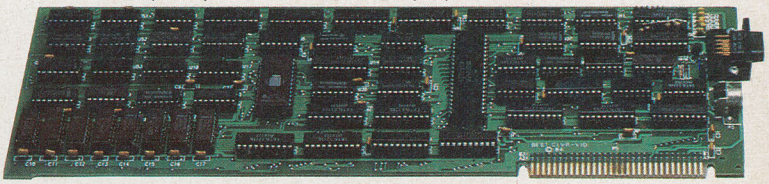
EPROM Programmer **$99.00** (with ZIF Socket Adapter **$159.00**)

BEST 512K RAM BOARD



SPECIAL: $229.00 with 512K. With 64K **$149.00**

Colour Graphics Video Board
$179.00 (Composite and RGB Output)



Quantity, Students and Teacher discount's available.

CHARGEX master charge

Exceltronix Computer Division Computers at unbeatable prices! (416) 921-8941, 319 College St., Toronto, Ontario M5T 1S2

EXCELTRONIX

No returns or exchanges after 7 days. 15% restocking charge.
Prices may change without notification
217 Bank Street, Ottawa (613) 230-9000

1-800-268-3798 — Order line only

Circle No. 3 on Reader Service Card

EXCELTRONIX

Long Distance Order line only: 1-800-268-3798

319 College Street, Toronto, Ont, M5T 1S2 (416) 921-8941
217 Bank Street, Ottawa, (613) 230-9000 **Mail Order Enquiries (416) 252-5285**
We guarantee you the combination of BEST Prices & Service in Canada!

New from Star Micronics SG-10 Printer

• Dual Mode - NLQ/draft standard (NLQ = near letter quality) • 120 CPS and 20% faster throughput • Bidirectional logic/seeking • 2K buffer (expandable to 6K with optional buffer interface) • 100% IBM PC or Star standard control codes-switch selected • Friction and tractor standard • full 1 year warranty • 10" wide carriage • Standard parallel interface (serial optional) **$399.00**

SG-15 same as SG-10

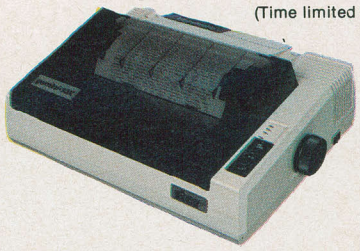
Except with 15" carriage and standard 16K buffer **$599.00**

Radix — $995.00 SR-15 $995.00

Star Micronics Gemini 10X 1 year warranty

• 120 c.p.s., • 816 characters print buffer, option 4K or 8K • standard parallel optional RS232C • tractor & friction feed. **Super Special $299.00**

(Time limited offer)



POWER TYPE LETTER QUALITY **$599.00**
• 18 CPS bidirectional logic seeking.
• 96 Petal Wheel

IBM COMPATIBLE KEYBOARDS

Cherry **$135.00**
Maxiswitch **$135.00**

Super Special
Keytronics Programmable Keyboard (no case) $69.00

IBM Compatible Disk Drive SA455

(with warranty) **$169**

CASES FOR YOUR IBM Compatibles

• Hinged top cases allowing easy access by opening top half of the case. Can be supplied with plain back or for 5 or 8 slots. Please specify when ordering. **$74.95**

• Above case with power supply and fan
For Apple compatible 75 Watt **$169.00**
For IBM compatible 150 Watt **$219.00**
Hinged Case with 90W (max.) Power Supply with fan **$178.00**
As above with 175W (max.) Power Supply and fan **$228.00**

APPLE COMPATIBLE DISK DRIVES

Now also available for Apple IIc

Famous Multiflex Disk Drive

$199.00 1 year full warranty.

Features:
• Apple compatible • Attractively packaged • Professionally built and tested • Canadian Made. We believe that Multiflex put out more drives in the last year than all other Canadian manufacturers combined.

Monitors

Zenith Data Systems

BEST SELLER ZVM 122A • 12" diagonal screen • non-glare amber display • composite input • 25 lines x 40/80 characters **$135.00**

BEST SELLER ZVM 123A • 12" diagonal screen • non-glare green display • composite input • 25 lines x 40/80 characters **$125.00**

ZVM 133 • 13" diagonal screen • RGB input • 25 lines x 80 characters • 640 x 240 pixels green screen only switch • 16 colours including PC brown **$749.00**

Peripherals for your Apple

Z80	$ 43.00
80 x 24 Video Card with Soft Switch	$ 67.00
16K RAM Card	$ 43.00
128K RAM Card with 128K	$ 99.00
Parallel Card with Cable	$ 59.00
Serial Card	$ 69.00
Apple Programmer	$ 65.00

Multiflex 300 Baud Modem

For your Apple (Super compatibility) **$159.00**

BEST IBM Compatible Modem

• Plugs into motherboard
• Excellent Hayes compatibility
• Auto Dial, Auto Answer, Directconnect

300 Baud **$179** 300/1200 Baud **$379**

Hard Disk Drives

Seagate (industry favoured)
10 MEG. slimline **$889.00**

10 MEG Seagate, slimline drive and hard disk controller. This controller can handle up to two 10 MEG hard drives. **LOWEST PRICE OF $1099.00**
Quantity Discounts Available
Seagate 20 MEG. slimline **$1099.00**
Seg 20 MEG. with controller **$1395.00**
Controller alone (for 10 or 20 MEG) **$349.00**
Cables (for 10 or 20 MEG) **$38.00**

MEMORY Untouchable Prices!

Guaranteed Prime Stock
Dynamic RAMs

4116 1x16k (150ns)	$ 0.75
4164 1x64k (150ns)	$ 1.49
4164's (150ns). Set of 9	$12.99
41256 1x256k (150ns)	$ 9.95
41256 (150ns). Set of 9	$89.00

Static RAM

2114L 4x1k 200ns	$ 2.25
6514 4x1k CMOS 450ns	$ 1.20
6116 8x2k 150ns	$ 5.95
2016 8x2k 150ns	$ 4.99
6164 8x8k 150ns	$29.00

EPROMS

2716 450ns 8x2k	$ 5.50
2716 300ns 8x2k	$ 6.50
2732 450ns 8x4k	$ 4.89
2732 250ns 8x4k	$ 4.89
2764 300ns 8x8k	$ 5.89
27128 350ns 8x16k	$11.95

EPROM Program $99.00
(with ZIF Socket Adapter $159.00)

Special Parts for your IBM & Apple Compatibles

Intel Parts

8087-2 (High Speed)	$259.00
8087	$219.00
8088	$14.50
8237A-5	$14.50
8250	$10.95
8253A-5	$ 7.45
8255A-5	$ 6.90
8259A	$ 6.95
8284A	$ 7.75
8288	$14.95
NEC765/8272 Equiv.	$12.95
74LS322	$ 5.95
62 Pin Card Edge Connectors	$ 2.19
5 Pin Din Connector	$ 0.99
100ns Delay Line	$ 5.89
6502 CPU	$ 5.45
Z80A CPU	$ 4.50
68A45 CRT cont.	$ 9.75
TMS99532 FSK Modem	$17.95
Set of 8088, 8255A-5, 8237A-5, 8288, 8284, 8253A-5, 8259A	$64.00

High Quality AMP IC Sockets

8, 14, 16, 18, 20, 24, 28 and 40
1.5 cents per pin
Quantity discounts available

Bypass Capacitors

0.1 uF, 50V ..... **.13¢**
100 pieces **$9.00**

Fans

New 3in fan **$12.95**
New 4in fan **$13.95**

We have the best prices on 74LSXX TTL Series e.g:
74LS-00, 02, 04, 08, 10, 32 at **29¢ each**
74LS-138, 139, 158, 175 at **69¢ each**
74LS-244, 245, 273 at **$1.19 each**

Circle No. 26 on Reader Service Card

We just couldn't resist.

We said we'd never do another dealer ad.

But we just had to show you our new packaging.

You see, we're spending millions on advertising to show it to your customers.

Which means they could come through your door looking for it. Any minute now.

And if that doesn't have you running to the phone to stock up, consider all this.

The new life-time warranty on Dysan®'s 100% surface certified diskettes is another clear statement of our better quality.

New Point-of-Purchase displays, dealer incentives, plus product training, free sales manuals and a toll-free hotline.

Now that you've seen our new box and what's in it for you, we'll try not to do this again.

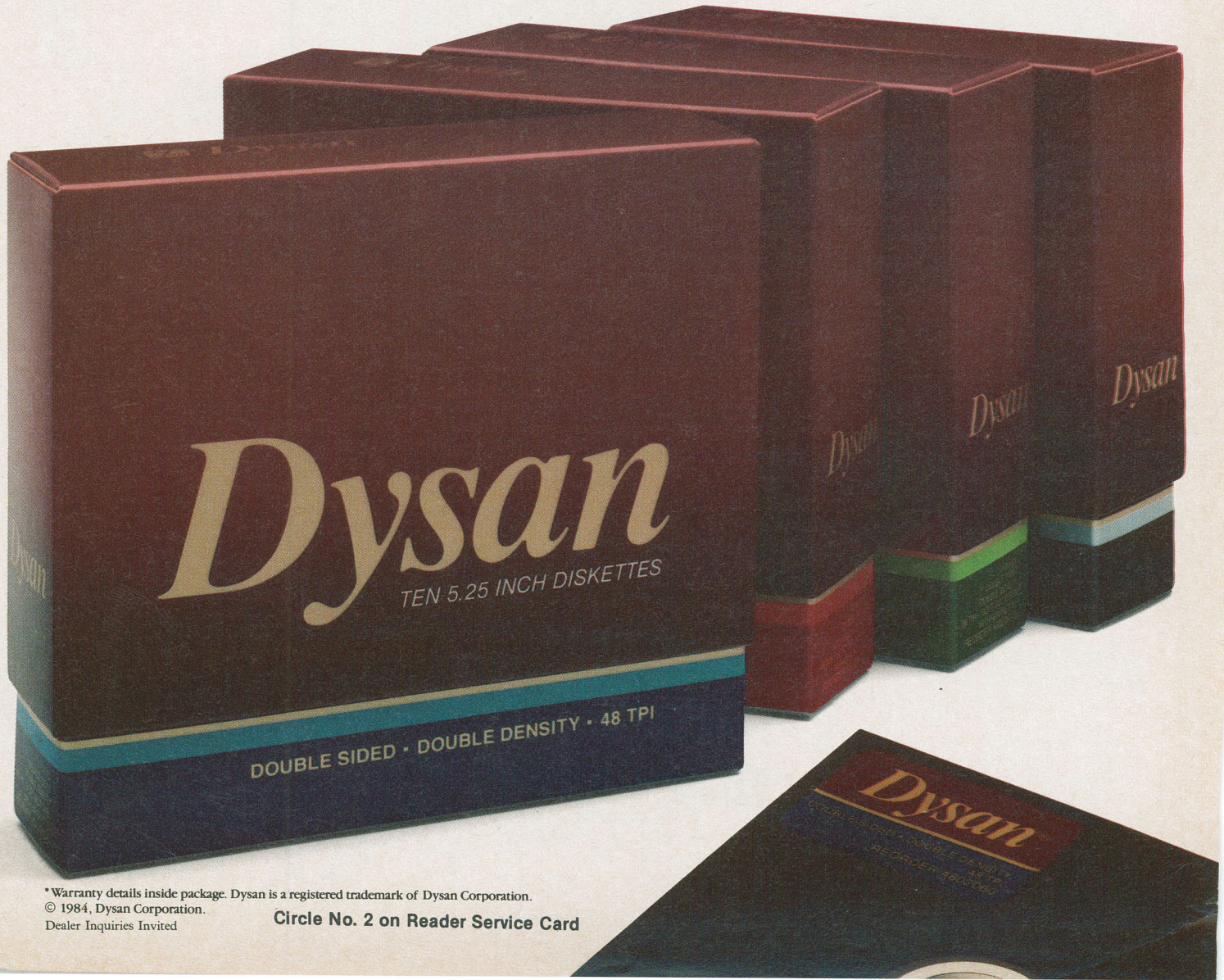
But if something comes up, well, we know you'll understand.

To order more diskettes contact your Dysan distributor and/or if you wish to find out how you can be a Dysan dealer call 1-800-387-9635.

DYSAN CANADA INC., 80 Riviera Drive, Markham, Ontario L3R 2L6.

Dysan®

Somebody has to be better than everybody else.



*Warranty details inside package. Dysan is a registered trademark of Dysan Corporation.

Dealer Inquiries Invited

Circle No. 2 on Reader Service Card

Computing Now!

Canada's Personal Computing Magazine

Volume 4 No. 4
August 1985

This month's cover photograph is the work of Bill Markwick. The terminal were supplied by Software Link, who do LanLink and MultiLink. There are words about this software ... and a bit about the terminals, for that matter ... in this month's Software Now!

We had to lay a rest on the music issue due to unforeseen complications. If you listen closely, however, you can hear it coming.

Published by
Moorshead Publications
Suite 601, 25 Overlea Blvd.
Toronto, Ont. M4H 1B1
(416) 423-3262

EDITOR
Steve Rimmer

ASSISTANT EDITOR
Marie Hubbs

DIRECTOR OF PRODUCTION
Erik Blomkwist

CREATIVE MANAGER
Ann Rodrigues Maia

PRODUCTION
Douglas Goddard
Naznin Sunderji
Sandra Hemburrow

CIRCULATION MANAGER
Lisa Salvatori

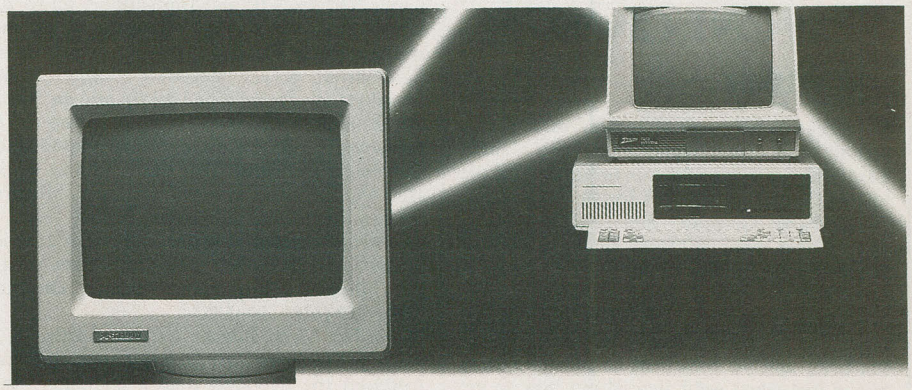
ACCOUNT MANAGER
Denis Kelly
Toronto (416) 423-3262
Montreal (514) 735-5191
Vancouver (604) 688-5914

Publisher: H.W. Moorshead; **Executive Vice-President:** V.K. Marskell; **Vice-President - Sales** A. Wheeler; **General Manager:** S. Harrison; **Controller:** B. Shankman; **Accounts:** P. Dunphy; **Reader Services:** N. Jones, L. Robson, M. Greenan, H. Brooks, R. Cree; **Advertising Services:** A. LeBrocq

NEWSSTAND DISTRIBUTION
Master Media, Oakville, Ont.
PRINTED BY:
Heritage Press Ltd., Mississauga
SUBSCRIPTIONS
$22.95 (12 issues) $37.95 (24 issues)
Published 12 times a year
Outside Canada (US Dollars)
U.S. add $3.00 per year
Other countries add $5.00 per year
Moorshead Publications also publish Electronics Today, Computers in Education, and Software Now!

POSTAL INFORMATION
Second Class Mail Registration No. 5946. Mailing address for subscription orders, undeliverable copies and change of address notice is:
Computing Now!, Suite 601, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1

Printed in Canada ISSN 0823-6437.



Sectors

COMPUTER PRESS

More Micros

COMPUTING NOW! — Believe it or not, this exhausts the 'New Computers' section of the official (accept no substitutes) Computing Now! press release pile. Mind, I'm writing this before I see today's mail.

• California-based *Corona Data Systems Incorporated* have announced the market's first transportable IBM PC/AT compatible computer. The *Corona ATP* — for AT Transportable — is an Intel 80286, MS-DOS based computer featuring a built-in colour/monochrome graphics card, nine inch non-glare green monitor with 640 by 400 pixel resolution, 512K RAM, serial and parallel ports and five expansion slots (three AT and two XT compatible). The computer's two available models differ only in disk capability: The ATP-6-QD features one 1.2 megabyte floppy and one 360K floppy, and the ATP-6-Q20 has a 1.2 megabyte floppy and a 20 megabyte hard drive. Suggested U.S. retails are quoted at approximately $4,500.00 for the ATP-6-QD and $5,500.00 for the ATP-6-Q20. Both models are bundled with DOS 3.1.

Corona Data Systems Incorporated is headquartered at 275 East Hillcrest Drive, Thousand Oaks, California 91360 (805) 495-5800.

Circle No. 59 on Reader Service Card.

• The *NelmaWriter* from *Nelma Data Corporation* is intended as a small office typewriter replacement system, and consists of a CP/M based, 64K Nelma Persona computer, a 12 inch monochrome monitor and a bidirectional daisy wheel printer. Software included in the $1,995.00 system includes WordStar and NelmaType — a program that enables the daisy wheel printer to act as a straight character-by-character correcting typewriter.

Nelma Data Corporation is located at 5170A Timberlea Boulevard, Mississauga, Ontario L4W 2S5 (416) 624-0334.

Circle No. 58 on Reader Service Card.

• The *Altos 2086* computer from *Altos Computer Systems Incorporated* features an eight megahertz 80286 microprocessor, operates under XENIX 3.0, and can support up to 20 users. In its base configuration, the system includes two megabytes of RAM, an 80 megabyte hard drive, a 1.2 megabyte floppy, a 60 megabyte streaming tape backup and an Altos III terminal. RAM may be expanded up to 16 megabytes, and hard drives can be upgraded to 240 megabytes. The 2086 can read and work IBM PC/AT disks and can run most software written for the PC/AT under XENIX.

Altos' Canadian office, Altos Canada, is at the Sun-Life Tower, 150 King Street West, P.O. Box 50, Suite 1815, Toronto, Ontario M5H 1J9 (416) 593-5655.

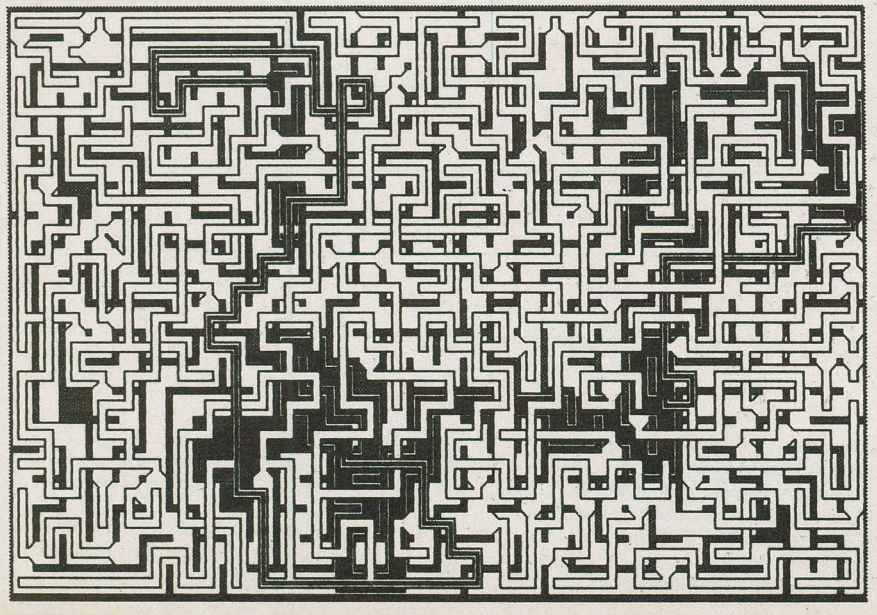
Circle No. 57 on Reader Service Card.

• *Sharp Electronics of Canada Limited* has introduced the *PC-1260* pocket computer. Inherent within ROM is Easy Simulation, a program which accepts English commands when the user is inputting equations. Expanded

First CN! Giveaway Winner

We recently were successful in our search for a second hand cherry picker truck with a sufficiently high arm to allow us to hover over the pile of entries we received for the First Computing Now! Giveaway and select a winner. The winner was, in fact, Kevin Wittal of Regina, Saskatchewan, who now owns a General DataComm intelligent modem.

Sadly, the mail for the Second Computing Now! Giveaway has already surpassed that of the first, and we have had to sell the cherry picker just when we'd figured out how to get her into third. Anyone knowing of a cheap second hand helicopter with oxygen equipment is asked to contact us.



Next Month In

Computing Now!

Boards of the Rings

In the next edition of Computing Now! we'll be taking a three hundred baud odessy around the continent checking out the most interesting bulletin boards. Some of these things are intensely useful . . . others are extremely weird. Many are extremely specialized, and offer all sorts of new insights into things like the space shuttle and electric music. Did you know that there's a Grateful Dead board?

Patching WordStar on the PC

There are a lot of things about the IBM implimentation of WordStar that its users would dearly love to change. In the next Computing Now! we'll be having a shot at adapting WordStar to make it convenient for your applications. You will be able to patch it, change its defaults and generally make it into what you want it to be, rather than the other way around.

Understanding BASIC

Anyone can get BASIC to print a few filthy limericks, zap through a few loops, graph the odd trig function... but if you are privy to its innermost secrets there is no end to the sorts of things you can get it to come up with. Next month we are going to make BASIC dance smartly about the room and jump through hoops . . . not an easy thing for a floppy disk.

These features are in an advanced state of preparation and if the gods smile on us you'll see them. The gods are a bit fickle at times, however, and we do reserve the right to change the final contents of the issue prior to our going to press.

BASIC command capability is offered for the more experienced user. The PC-1260 features 4.4K of RAM, an 8-bit CPU, a dual-line 24 digit liquid crystal display, a Help function and 18 definable keys. Available from authorised Sharp dealers, the computer has a suggested retail price of $159.95.

Sharp Electronics of Canada Limited is located at 335 Britannia Road East, Mississauga, Ontario L4Z 1W9 (416) 890-2100.

Circle No. 56 on Reader Service Card.

Obituary

DECEASED — *VisiCalc*, eight year old brainchild of Robert Frankston and Dan Bricklin; of a corporate decision, June, 1985.

Born in 1978 in Cambridge, Massachusetts, to parents Software Arts and Personal Software (later VisiCorp) the original 6502 implementation of the spreadsheet program was said by some to be the catalyst that boosted not only the Apple][, but micros in general, from hobbyist's basements to small businesses. The program's forecasting ability made the Apple][and VisiCalc a very popular combination in the marketplace at the time.

The program's success led Software Arts to develop siblings, collectively entitled the VisiSeries. *VisiPlot* and *VisiTrend*, two VisiCalc enhancement programs usually purchased together, were popular within the VisiSeries, and were written by Mitch Kapor. More about Mitch shortly.

As myriad 'me too' programs — often referred to as 'Visiclones' — continued to surface for every imaginable micro, VisiCalc faced other problems, including a custody battle between Software Arts and VisiCorp. By this time, however, superior spreadsheet software products were on the market, and VisiCalc sales, despite various implementations of the program, were no longer robust.

In April, 1985, Lotus Development Corporation — founded by Mitch Kapor and Jonathan Sachs, and producers of *Lotus 1-2-3* — acquired Software Arts Incorporated. By June, Lotus announced its decision to bury VisiCalc, stating simply that more powerful programs were presently available. Other Software Arts programs, such as *Spotlight*, are unlikely to be discontinued at this time.

VisiCalc is survived by — well, every spreadsheet on the market, if not every business package. If it won't be missed, it will surely be remembered.

New Products

The **SmartPro 103/212A** smart modem is compatible with Hayes' Smartcom and Crosstalk software and features pulse and tone dialling, auto answer/dial, a built-in speaker and more. Introduced by *TEO Computers and Peripherals Incorporated,* the 300/1200 baud modem is supplied with PC-Talk software and a modem cable...

IBM applications requiring frequent disk access will benefit from **Invisible Optimizer,** a product of *Stellation Two Incorporated.* Incorporating the speed benefits of a RAM disk, the program uses a mainframe technique known as disk cacheing to reduce the amount of time spent waiting for either floppy or hard drives to access information...

Less than half the thickness of competitive digitizing tablets, the **GTCO Micro DIGI-PAD** is available in 6" by 6" or 12" by 12" active area sizes. The pad's surface is smooth, unbreakable and non-glare. The product is available from *Interwold Electronics and Computer Industries Limited...*

Circle No. 55 on Reader Service Card.

Continued on page 62

HEADACHE #43:

"There has to be a way to keep track of overdue accounts!"

Now available for IBM-PC, Compaq, PC-compatibles, and many multi-user Systems

☐ Remedy: IntoTeam™ All-in-One

Reach for the InfoTeam, The All-in-One family of software that calculates numbers, maintains important records, bills customers, prints checks, produces financial statements, tells you who's paying on time and who's delinquent.

InfoTeam is designed for growing businesses in manufacturing, wholesaling, retailing, service industries and accounting.

☐ IBM® -PC Productivity and Accounting Software that works together

The All-in-One is a series of proven software that includes these applications:

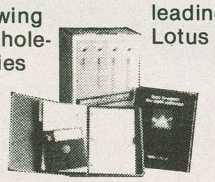
— WordStar® and CorrectStar™ word processing and spelling correction
— CalcStar® advanced electronic spreadsheet
— DataStar® records management system
— InfoManagement Accounting including: General Ledger, Accounts Receivable, Invoicing and Accounts Payable

☐ Your Benefit

InfoTeam helps improve your cash flow, eliminates paperwork, pinpoints profitable and non-profitable areas, saves money by eliminating bookkeeping services, and speeds up collections.

☐ Painless integration

No hype! InfoTeam software works together so you can easily move information from one application to another. For example, you can use data from your accounting system in your spreadsheet for financial analysis, or use your prospect mailing list to send personalized letters. InfoTeam also works with other leading products including Lotus 1-2-3™ and dBase II®



Software you can grow with

InfoTeam is available in single-user and multi-user versions, featuring "record lockout" for true networking. So you can start with one PC then upgrade to a total network as your business grows.

☐ Backed by a leader

Info Designs is a leader in microcomputer software. We now support over 120,000 accounting users worldwide. We back every product with our commitment of quality and service.

Find out how InfoTeam can benefit your business . . . send us your business card or letterhead for our 48-page booklet "How to Select the Right Software."

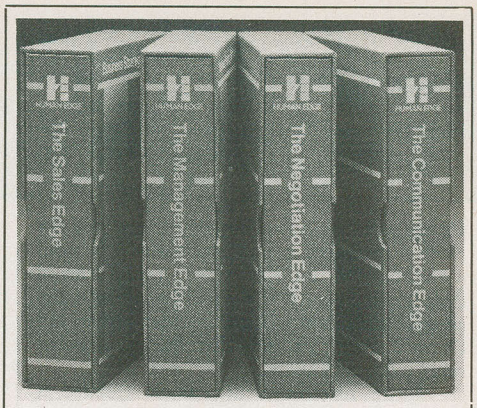
InfoDesigns™

The business software worth buying a computer for.

Dealer inquiries invited

Phase 4 Distributors Inc.
7157 Fisher Road South East
Calgary, Alberta T2H 0W4

HEAD OFFICE (403) 252-0911
Toronto (416) 928-1081 Vancouver (604) 943-5703



For success-minded business people

"Get the edge"

Human Edge Software

Use it to guarantee your success

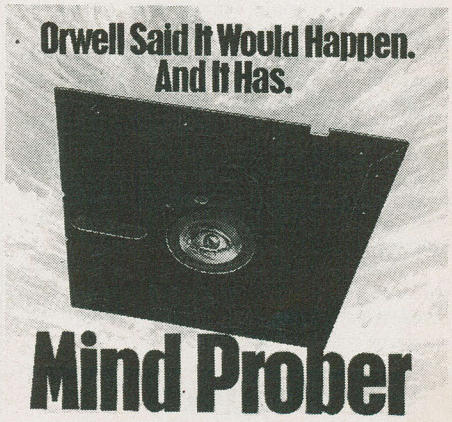
- **Sell more products**
- **Get better management results**
- **Win more negotiations**
- **Speak more effectively**
- **Delegate decision-making effectively**
- **Read others accurately**

Human Edge Software Corporation, the leader in practical expert systems, brings you software products to improve your effectiveness in your career, to share your expertise with others and to have fun:

- The Communication Edge
- The Management Edge
- The Negotiation Edge
- The Sales Edge
- Expert Ease
- Mind Prober

These products give you a collection of the strategies and tactics winners use to succeed, fit to your personality—and the personality of the person you choose to persuade—by your computer.

IBM — Apple —
Macintosh — Commdore*

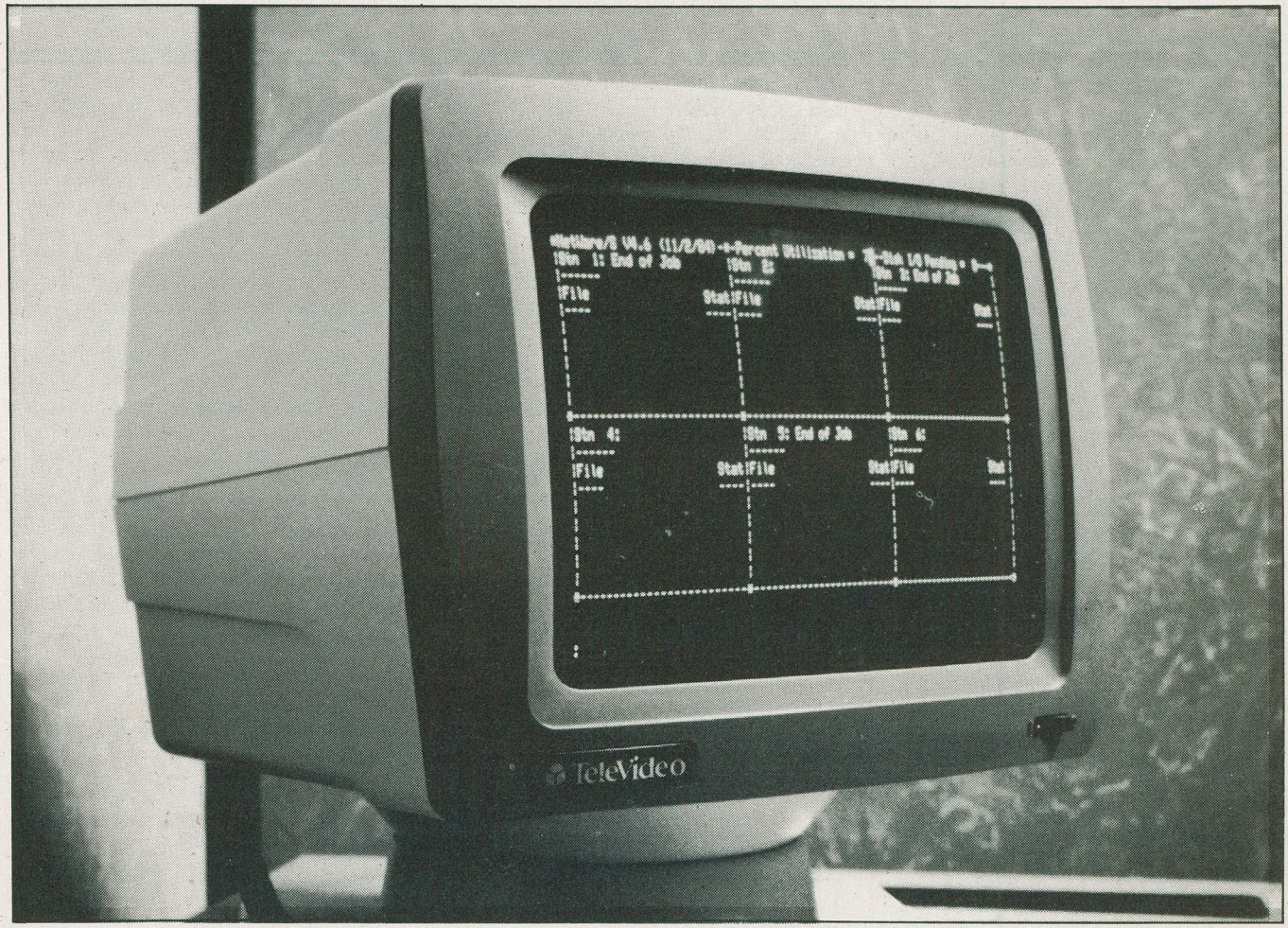


Phase 4 Distributors Inc.
7157 Fisher Road South East
Calgary, Alberta T2H 0W4
HEAD OFFICE (403) 252-0911

Toronto (416) 928-1081 Vancouver (604) 943-5703

Circle No. 5 on Reader Service Card

Share the LAN



LANs are one of those splendid technological mysteries for most people. However, applying a LAN to your business can avail you of a quantum leap in the power and productivity of your computers. Here's a look at what's really involved in using a local area network.

by Frank Lenk

Anyone vaguely interested in computers and their applications will have heard an awful lot about LANs lately. However, for the majority of us, LAN remains just an acronym. LAN stands for local area network... but even if you already knew that, there would still be a lot of gut feeling missing.

The trouble is, of course, that very few computer users have had much chance to get exposed to LANs. Only the larger companies have gotten around to installing them, so unless you work for one of those few this whole LAN business may seem to be passing you by.

One of the leading edges of LAN technology, however, is the downward spiral of the low end. LANs are becoming a lot more affordable... perhaps more so than you might think... and many small businesses can now reasonably expect to apply networks.

As you probably found when you bought your first computer, dealer demonstrations and literature rarely tell you what this technology can do. In this article we're going to have a look at what it's really like to use application software on a real world local area network.

LAN Sakes!

Prior to actually writing this article, I spent some time with two of the most significant LAN systems around, these being Novell's NETWARE and Corvus' Omninet. Corvus... one of the more elderly systems... lays claim to the largest installed user base among all networks. Novell, on the other hand, is a bit of an upstart, offering some interesting features that make it among the most advanced network systems available.

Corvus started life in 1979 as Andorra Systems, selling the first Winchester hard disks for the Apple II. The company was shortly renamed in honour of a Roman

Share the LAN

emperor who was rumoured to have defeated a Gaulish giant by having a raven blind him. A bit grisly, I'll grant you, but then they have to get those names somewhere.

The company's first LAN was brought out in 1980. Corvus now has over five hundred LANs operating in Canada alone. Worldwide it has over twenty–one thousand LANs installed, for a total of over two hundred thousand nodes. Corvus estimates the entire LAN market so far at only four hundred to four hundred and fifty thousand nodes, which would imply that it has roughly half of the whole ball of wax.

Up 'til now Corvus. has enjoyed the status of being a sort of standard in LANs. This could be changing since IBM's announcement last year of a LAN of its own.

You might start by asking what a LAN is. Here's the short version. A multi-user system... the evolutionary precursor to a local area network... is a way of letting a number of people share the use of a single computer. A typical multi user configuration consists of a minicomputer or a moderately powerful micro... such as a PC AT... surrounded by a bunch of dumb terminals.

A LAN is sort of similar, except that the processor of the central computer is not shared. Instead, the LAN allows numerous standalone PCs to share peripheral resources such as hard drives, printers and whatnot. This can be a very nice situation if large amounts of data must be pooled at a central location, or if a single very expensive piece of hardware... such as a laser printer or a massive hard disk... is to be used by several people.

One of the LAN stations is usually designated as the 'file server' or 'disk server'... a sort of super station and all round controller. Shared hardware tends to congregate around the server. A conceptual limitation of LANs is built right into the definition 'local area'. Typical connections between LAN stations are measured in thousands of feet. Allowing for the inevitable meanders, this usually amounts to one floor of an office building.

Net Worth

As networks go, Omninet is pretty typical. Considering Corvus' expertise in Winchester disks, it isn't surprising that the main works are built right into the hard drive boxes. These come in sizes from five, to a hundred and twenty–six megabytes. Setting up an Omninet system is mostly a matter of plugging peripheral cards into however many workstation PCs one has and wiring the whole mess together... using simple twisted pair cable.

In Canada this amounts to somewhat under nine hundred dollars per station... plus anywhere from three thousand to fifteen thousand for the hard disk unit, depending on how many megs it takes to make you happy. Bear in mind that half to three quarters of a megabyte is soaked up by the LAN system software.

To get technical for just a minute... it'll be over before you know it... Omninet uses a 'bus' architecture, meaning that the workstations are strung along a single central data line. Bus contention is an obvious problem, considering that any number of stations could start screaming for attention at any given microsecond. The usual solution is *collision detection*, with one of the stations subsequently backing down.

Corvus claims to go one better, with *collision avoidance*. This lets the bus's actual throughput get a little closer to the theoretical top speed of a million bits per second.

Omninet... the hardware... runs software called *Constellation*. As with most LANs, the first thing the user sees of this is a fairly insistent login prompt. In the case of Omninet you'll be asked to enter your name.

Once you're in, you'll have a tough time even recognizing that you are on a network. From any of the workstation PCs the file server drive looks like just another disk drive. Omninet assigns a virtual drive letter to the remote disk, so on a single floppy PC workstation you'll probably find the server drive under C: just as you would an internal hard drive or a RAM disk.

The only place you really bump into networking is through a series of utility programs. Two of the most important come as a pair of files, SPOOL and DESPOOL. These handle printing and generally moving files from station to station. Both utilities are menu driven.

In firing up SPOOL you are asked for various parameters, including the "pipe" file name, the number of lines per page, tabs and so forth. The pipe file acts as a queue. You run DESPOOL to pull files off the queue and shove them into the appropriate destinations... usually the printer.

Networking software still has a long way to go. Omninet, for instance, has only limited ability to control a file's usage. Any user has access to any file in any public volume. A volume is another word for a subdirectory. Entire volumes can be assigned to specific users, but that's as far as it goes.

The Omninet software may be spartan, but it certainly is functional, and it is supported by well proven hardware. There's kind of a lot of hardware you can get into, as long as the corporate budget holds out. In addition to Omninet itself you can also go for Omnishare... sort of the same thing but designed to use any PC XT as a file server. To go with this you can grab the *Trim Line Combo*, which consists of a twenty megabyte hard disk and a forty–five or sixty megabyte tape backup packaged side by side in a thin box designed to sit on top of a PC. Like most of the newer tape drives, it allows either bulk or file backup. It costs about six grand north of the border.

A micro based Omninet LAN can be expanded into the world of mainframes with the SNA *Gateway*, which lets you hook onto passing mainframes. The Gateway has its own 68000 CPU, will emulate a 3270 terminal, and costs about fifteen thousand dollars.

If you're willing to wait a bit there'll be a couple more nice extensions to Omninet. By this fall there should be Omnitalk, an AppleTalk LAN to Corvus hard disk connection for the Macintosh. I saw this one actually up and running, so I am now one of the three or four people who can truthfully report seeing a hard disk icon come up on the Mac desktop screen.

The OmniTalk system works much like PC based Omninet, with the hard disk volumes acting just like regular drives from the user's point of view. However, the Mac system allows only six hard disk volumes to be online at one time, so Corvus supplies a *Mount Manager* utility... complete with windows and pull downs... to help you shuffle desired volumes onto the screen. OmniTalk also includes a *volume manager* to permit creation and modification of disk partitions. Like Omninet, the system supports up to 512 volumes, each of which can range from four hundred kilobytes to over three megabytes.

Also expected shortly is Omninet II. To be available early next year, the new model will feature a *star* topology, a custom VLSI implementation by NEC and line transmission rate of four megabits per second over existing spare phone wires.

Get a New LAN, Stan

When you talk about Novell's NetWare, you have to be careful to be sure you know exactly what NetWare you mean.

NetWare/S is Novell's own network, complete with a file server and wires. However, there are at least ten other versions of NetWare, such as NetWare/O, NetWare/D, NetWare/N... the alphabet beckons. The amazing fact is that NetWare software is available for just about any LAN hardware on the market.

ALL THE BEST PRICES

IBM, ZENITH, COMPAQ, CORONA, ITT .....CALL

HOME COMPUTERS

IBM

EXPANSION CHIPS
64K (set) $16.95
256K Chip ..... $ 7.95

AST RESEARCH
Six Pak Plus .....from $399.00
Combo Plus II .....from $449.00
Mega Plus.....from $475.00
I/O Plus .....from $225.00
Reach 1200 Baud Modem $649.00

HERCULES
Graphics Card $479.00
Color Card $249.00

QUADRAM
Quadlink 64K $615.00
Quadboard II.....as low as $405.00
Quad 512 Plus.....as low as $405.00
Quadcolor I $319.00
Chronograph $135.00
Parallel Interface Board $105.00

PARADISE
Multi-Display Card $325.00
Modular Graphics Card $465.00
5 PAK $239.00

EVEREX
Graphics Edge $495.00
The Edge (mono/colour) $510.00
Magic Card $280.00
Disk Drives (IBM)
Tandon (full & ½ height) $199.00
Panasonic $199.00
Control Data $189.00

Call for new low pricing

850 Interface $179.00
1010 Recorder ..... $ 65.00
1020 Color Printer ..... $ 95.00
1025 Dot Matrix Printer $299.00
1027 Letter Quality Printer $399.00
1030 Direct Connect
Modem ..... $ 99.00
1050 Disk Drive $275.00
CX 30 Paddles ..... $ 18.00
CX 40 Joystick ..... $ 12.00

commodore

Call for CBM 4 plus

Commodore 64 ..... $229.00
C1541 Disk Drive $275.00
C1530 Data Set ..... $ 69.00
C1520 Color Printer/Plotters $199.00
MPS801 Dot Matrix Printer $229.00
C1702 Color Monitor $299.00
C1660.....300 Baud Modem ..... $ 99.99
MCS801 Color Printer $749.00
DPS1101 Daisy Printer $399.00
Magic Voice Speech Module ..... $ 85.00
C128 (new) $499.00
C1571 (new) $439.00
C1902 (new) $499.00
VIDTEX Telecommunications
..... $ 32.99

MSD DISK DRIVES
MSD1....Single Disc Drive $429.00
MSD2....Double Disc Drive $749.00

ASHTON-TATE
Framework $540.00
dBASE III $529.00
Friday $310.00

CONTINENTAL SOFTWARE
1st Class Mail/Form Letter $105.00
Home Accountant Plus $125.00

PSF
PSF File $129.00
PSF: Write $129.00
PSF: Report $129.00

LOTUS
Symphony $590.00
Lotus 123 ..... $389.00

MICRORIM
R:Base 400 ..... $419.00
R:Base 5000 ..... $599.00

MICROPRO
Wordstar 2000 ..... $410.00

MICROSOFT
Multiplan $199.00

MICROSTUFF
Crosstalk XVI $155.00

MULTIMATE INT.
Multimate $399.00

SPI
Open Access $549.00

VISICORP
Visicalc IV $299.00
VisiWord + ... $359.00
Optical Mouse $279.00

ATARI

600 XL $119.00
800 XL $129.00
130 XE (new) $249.00
520 ST, DD, Monitor $1,199.00
7097 Atari Logo ..... $ 95.00
4018 Pilot (Home) ..... $ 85.00
8036 Atari Writer ..... $ 59.00
5049 Visicalc ..... $ 49.00
488 Communicator II $185.00

SWP
ATR8000-16K Z80 CP/M $590.00
ATR8000-64K Z80 CP/M $795.00

BIT 3
Full View 80 ..... $349.00

ATARI DRIVES
Indus GT $389.00

PERSONAL PERIPHERAL
Super Sketch Graphics Pad ..... $ 61.99

APPLE

APPLE IIe/IIc/Mac ..... CALL

APPLE/FRANKLIN DISK DRIVES

MICRO SCI
A2 ..... $295.00

RANA
Elite 1 ..... $311.00
Elite 2 ..... $555.00
Elite 3 ..... $885.00

BATTERIES INCLUDED
Paper Clip w/Spell Pack ..... $ 99.99
The Consultant DBMS ..... $ 99.99
Bus Card II $175.00
80 Col Display $164.99

PRINTERS

AXIOM
AT-100 Atari Inter Printer $269.00
AT-550 Atari Bidirectional $419.00
AT-700 Atari Color Printer $759.00
GP-100 Parallel Interface $295.00
GP-550 Parallel Printer $379.00

C. ITOH
Prowriter 8510P $499.00
Prowriter 1550P $769.00
A10 Son of Starwriter 18cps $845.00
Hot Dot Matrix ..... CALL
F10-40 Starwriter $1,490.00
F10-55 Pinwriter $1,799.00

COMREX
ComWriter II Letter Qual $699.00

DAISYWRITER
2000 ..... $1,285.00

DIABLO
620 Letter Quality $1,252.00
630 Letter Quality $2,582.00

EPSON
Homewriters $349.00
LX 80 ..... $389.00
RX 80 ..... $349.00
FX 80 ..... $549.00
FX 100 ..... $839.00
LQ 1500 ..... $1,539.00
JX 80 (Colour) $849.00

IDS
Prism 80.....for config ..... CALL
Prism 32.....for config ..... CALL

JUKI
6100 ..... $639.00
6300 ..... $1,199.00

OKI DATA
OKIMATE 10 ..... $339. 00
OKIMATE 20 ..... $349.00
182, 183, 84, 92, 2350, 2410 ..... CALL

OLYMPIA
Compact 2 ..... $625.00
Compact RO $549.00
ESW 3050 ..... $1,999.00
Needlepoint $485.00

PANASONIC
KXP 1090 ..... $319.00
KXP 1091 ..... $399.00
KXP 1092 ..... $619.00
KXP 1093 ..... $799.00

SMITH CORONA
L-1000 ..... $498.00
Tractor feed $179.00

SILVER REED
500 Letter Quality $449.00
550 Letter Quality $725.00
770 Letter Qualtiy $1,315.00

STAR
SG10C - Commodore $429.00
SG10(new) $379.00
SG15(new) $659.00
Radix 10(new) $849.00
Radix 15(new) $1,049.00
Power (letter quality) $539.00

TOSHIBA
1340 ..... $949.00
1351 ..... $1,995.00
351(new) 300 CPS $1,995.00

MODEMS

ANCHOR
Volksmodem ..... $ 99.00
Mark VII (A Ans/A Dial) $149.00
Mark XII (1200 Baud) $399.00
9 Volt Power Supply ..... $ 14.99

HAYES
Smartmodem 300 ..... $245.00
Smartmodem 1200 ..... $649.00
Smartmodem 1200B $619.00
Micromodem IIe $279.00
Micromodem 100 ..... $459.00
Smart Com II $111.00
Chronograph $320.00

NOVATION
J-Cat $149.00
Cat $199.00
Smart Cat 103 ..... $269.00
Smart Cat 103/212 ..... $599.00
AutoCat $335.00
212 AutoCat $829.00
Apple Cat II $379.00
1200 Hayes Compatible $516.00
1200b Hayes Compatible $516.00
Smart Cat Plus $549.00

ZENITH
ZT-1 ..... $579.00
ZT-10 ..... $595.00
ZT-11 ..... $615.00

MONITORS

AMDEK
175 Green $199.00
300 Amber $219.00
310 Amber IBM $229.00
300 Color/Audio $399.00
500 Color/Comp/RGB/VCR $599.00

NAP
12" Amber $119.00

NEC
1260 Green ..... $ 85.00
1205 Amber $175.00
1215 Composite $375.00
1216 12" RGB TTL $659.00

PRINCETON GRAPHICS
MAX-12 Amber $329.00
HX-12 RGB $799.00
SR-12 RGB $999.00

ZENITH
ZVM 122 Amber $149.00
ZVM 123 Green $149.00
ZVM 124-IBM Amber $239.00
ZVM 135 RGB/Color $789.00

SANYO
CRT 30 Green $169.00
CRT 36 Green $199.00
CRT 70-14" RGB $819.00
CRT 6650 14" Color TTL $749.00
CRT 9212 12" tilt Green $349.00
CRT 1251 12" Green/Amber $349.00

TAXAN
TAA12...12" Amber $199.00
TAG12...12" Green $199.00
TAG121...IBM Greeen $229.00
TAA122...IBM Amber $239.00
TAC210...RGB/Colour $429.00
TAC400...Med Res RGB $499.00
TAC415...Hi-Res RGB $669.00
TAC420...Hi-Res RGB (IBM) $699.00

USI
Pi 1...9" Green $149.00
Pi 2...12" Green $160.00
Pi 3...12" Amber $150.00
Pi 4...9" Amber $160.00

QUADRAM
Quadchrome 8400 Color $825.00

COMPUTER MAIL ORDER

TELEX 06-218960 — **CANADA** — **TELEX 06-218960**

ONTARIO/QUEBEC
1-800-268-3974

(All equipment under full warranty in Canada.)
Price subject to change without notice.
(All orders Shipped within 48 hrs, upon payment.)

Dealer Inquiries Invited

OTHER PROVINCES
1-800-268-4559

TORONTO
828-0866

VISA

To order: Send money order, certified cheque, personal cheques must clear our bank, VISA or MASTERCARD. (Include card # and expiry date & signature) Add 3% for shipping and handling. Minimum $5.00 per order.

Ontario residents add 7% P.S.T.

MasterCard

Computer Mail Order Canada 2505 Dunwin Drive, Unit 3 • Mississauga, Ontario L5L 1T1

Circle No. 23 on Reader Service Card

Share the LAN

NetWare seems to be one of those rare instances of software designed by users and programmers, rather than by marketing men. The trick is modularity. With NetWare the workstation PCs run DOS... of whatever persuasion... and over top of that an interface shell driver program. This would probably be either NET20PC or NET30PC depending on whether the PC is running DOS 2.0 or 3.0. However, you could just as easily run CP/M or Pascal p-system. The shell program mediates between the chosen operating system and whatever network interface board is plugged into the workstation.

The beauty of this is that no matter what interface is plugged in and no matter what type of DOS is in use, all Novell has to do is rewrite the shell and NetWare rolls right along. You can even mix different operating systems on the same network. At the time of this writing there were versions of NetWare available for twenty-four flavours of LAN hardware, including Novell's own.

The memory overhead for the shell is no more than about eight to sixteen kilobytes. Programmers may be interested in knowing that the shell adds a whole mess of interrupt twenty-one functions to those normally provided by the DOS interrupt handler. These include obvious things to do with file handling, as well as many functions to do with the LAN's protocol, semaphores and stranger things.

As a user of a LAN, you can remain blissfully ignorant of interrupt twenty-ones, semaphores and all the other programming terms.

Splitting the LAN chores between local DOS and the shell lets NetWare run more efficiently. In most networks DOS will end up handling both the local floppy disk file handling and the server disk's directory maintenance. Not only is this somewhat redundant, it also tends to load DOS down more than usual. With NetWare the shell is responsible for handling server disk access.

Some of the results of this improvement are quite impressive. For instance, a one hundred kilobyte WordStar textfile save took as long as fifteen hundred seconds on a particular six station network but only sixty seconds on the same hardware running NetWare. No comparison at all was made for PC Net because it crashed when burdened with more than three stations.

Novell's file server software also has some unique enhancements built in. Its access speed is minimized by use of three programming tricks, to wit, disk caching, directory hashing and elevator seeking. Wait, let me explain that a bit.

The disk cache holds recently accessed files in RAM, so that subsequent access to the same files goes at, essentially, the speed of a RAM disk. Directory hashing refers to the internally indexed format of the server's directory entries. Elevator seeking implies that the server software is smart enough to figure a shortest path route for the disk drive's head to follow when it's traversing the disk in search of files. The server disk is formatted using a unique NetWare format. NetWare itself accounts for about two megabytes of space on the server.

Seeing Through

You might now ask what all this means to the suffering user. In fact, it results in a system that's very nearly transparent to the poor soul sitting at a workstation. NetWare acts a lot like DOS, but with the addition of a whole new repertoire of commands. In other words, if you can use a PC you can use this LAN.

Booting NetWare requires a floppy bearing DOS, COMMAND.COM and a copy of the shell program. One then types 'login' at the A► prompt, followed by the registered station name, that is, the identification of the particular workstation that one is huddled before. The system will come back with a mess of preset stuff, like for instance

SEARCH1 := Z:. [SYS:PUBLIC]

This does actually mean something.

Though logon parameters can easily be edited to suit each user, the SEARCH statement should remain since it assigns a file search path to the 'SYS:PUBLIC' directory... usually virtual drive Z:... where all the oft needed system utilities reside. In other words, at this point the network has created a virtual path... analogous to the one might create with the DOS PATH command... into the common SYS:PUBLIC directory. Presumably, one would put the applications software one wanted everyone on the network to have access to here.

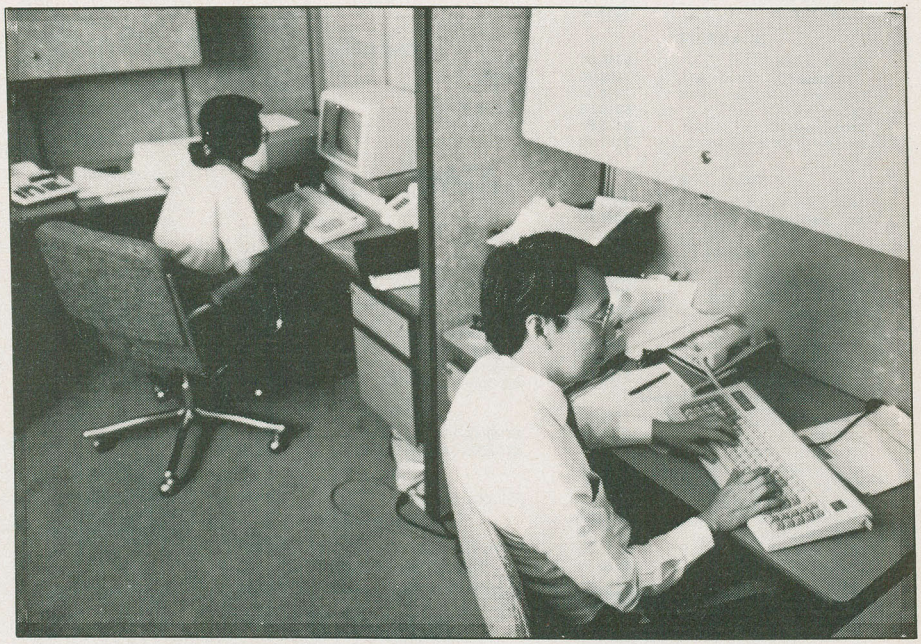
Other useful directories include SYS:ARCHIVE, SYS:MAIL and SYS:SUPER. These are default titles assigned by NetWare, for obvious reasons. SYS:SUPER is restricted to the network supervisor and contains all the heavy setup utilities.

You could now enter the command

A►WHOAMI

which would come back with your name, the number of your workstation and your login time and date. USERLIST will tell you who else is online.

You would probably be logged onto your own personal *home* directory, to which the supervisor would have granted you all rights, meaning you could read, write, create, open, delete, search and modify all files. In other directories you'd likely find your rights more restricted. In some directories you'd have no rights... you could get into the directory but couldn't even list the files let alone read or alter them. The command RIGHTS would tell you if the file listing on your screen is genuinely empty



or merely protected from your prying eyes.

As an example of the sorts of things one does on a LAN, the SEND command allows one to send a message to anyone else logged onto the system. However, any user can also invoke the command CASTOFF. This keeps you from being bothered by overly gregarious typists on the system. CASTON cancels the effect.

One of the more important commands takes the form

NPATH X := SYS:SOMETHING

This maps one of the system disk's directories onto a virtual drive named X:. Thus, instead of the usual CD command of DOS, you can just pretend to change drives. It's a bit shocking to change to drive Q, but it usually involves a lot less typing. As with the DOS PATH command, all NPATHs are lost when you log off. However, there's another command... a utility program, actually... that lets you get around this.

Typing SETLOGIN puts you in an edit screen. At the top you will likely see something like the first SEARCH command mentioned above. You can add anything you like to this. For instance

DRIVE F:
EXIT "LOTUS"

would automatically switch you to the virtual drive F and then run Lotus. You can even have conditionals... like "if day = Friday go to the ARCHIVE directory".

The supervisor could be real mean and keep the SETLOGIN program in his own directory and then assign you a login sequence that might automatically run WordStar and finally log you off immediately when you quit the program, thereby giving you absolutely no access to the system itself. This kind of antisocial measure is not usual, of course.

It does, however, illustrate the power of the system. Its owner can create turnkey systems for inexperienced users. In the scenario above, for example, one could set things up so that a secretary who only used the system to type letters wouldn't have to worry about paths, directories or anything else. As soon as she told the computer who she was it would make sure she only had to deal with WordStar.

All this may seem complicated, but really it means getting to know just a couple of dozen new commands, most of which one would rarely use and almost all of which are essentially variants on more common DOS commands. If you get really confused, there's one other command, HELP. Typing HELP at the prompt will get you an index screen including a list of all the NetWare commands plus instructions for the use of HELP itself. If you're really confused you don't even have to go through the HELP index. The system is smart enough to understand a query such as "How do I use login?"

There's a total of a hundred and thirty-eight help screens online, so there isn't much you can't learn from the system itself.

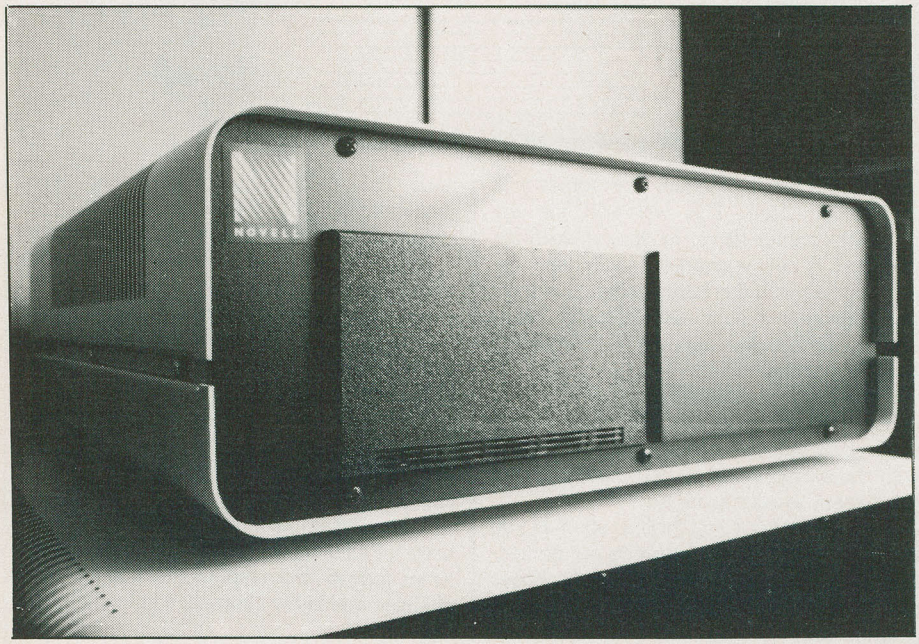
Novell LAN systems are handled in Canada by Drake International... the Office Overload personnel organization. Naturally, Drake also handles all manner of training... including how to use one's new LAN.

NetWare sells for $2395 Canadian... which covers file server software to run on existing LAN hardware. The software is protected by a key card that contains an encoded chip. You can't run the software without the card.

Novell's own star topology system starts at over twenty-two thousand dollars. This includes a 68000 based file server unit and a megabyte of RAM, a twenty meg hard disk, four workstation interface cards plus all the software and cabling. If you must, you can go up to a one hundred and twenty-six megabyte server drive, with up to three megabytes of RAM. As many as eight servers can be hung on a single LAN. In such a case all the path names mentioned above would become something like SYS1:PUBLIC, SYS2:PUBLIC and so on, the number indicating which server is being accessed.

NetWare may well be the most advanced LAN system in existence. Not only is the software remarkably complete and well thought out, there's also a wealth of other support available. The *Bridge* allows one to access one's LAN by modem. Several modems can run on a single Bridge. Another Bridge board allows a PC to link together any two LANs. A Gateway allows any LAN to connect to a mainframe computer... directly or by modem.

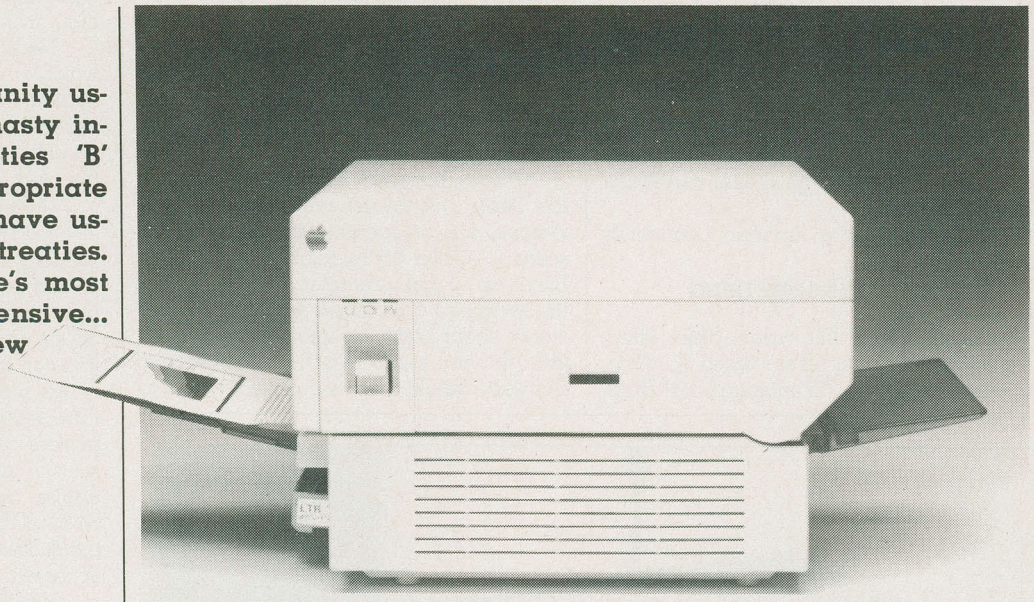
In fact, it's getting so that you can connect just about anything to anything. **CN!**



Apple Laser Writer

Remember when humanity used lasers against the nasty invading aliens of fifties 'B' movies? Given the appropriate hardware, they could have used 'em to draft peace treaties. Here's a look at Apple's most extensive... and expensive... printer to date plus a few Macintosh innovations.

by Frank Lenk



Very few microcomputers owe their survival to the availability of a good printer. Actually, the Macintosh may be the first to achieve this dubious honour.

There's no doubt that the Macintosh is the cutest computer on the market. It looks sporty in its compact cycloptic enclosure, and it's great fun at parties. Unfortunately, none of this demonstrates conclusively that it can actually be useful to have kicking around the office.

The arrival of Apple's LaserWriter... along with a few inconspicuous additions in the way of software... may be just what it takes to establish the Mac as a proper business tool.

The Paper Route

Unlike a lot of other computer peripherals... but entirely in keeping with the user friendly Macintosh dogma... the LaserWriter is a breeze to set up. However, you do have to go the roundabout route... through AppleTalk.

AppleTalk, of course, is the new Macintosh network connection. Physically this takes the form of a cable with a matchbox sized interface built into it. You just plug this sucker right in the back here... and plug a similar doohickey into your LaserWriter. You might be able to do without the AppleTalk wiring if you really wanted to... but considering the price of the LaserWriter, you probably wouldn't. The ten thousand dollar price tag really makes sense only when divided by several Macs. At least AppleTalk is cheap at only eighty bucks a cable.

The next thing to do is to tell the Mac that the LaserWriter is there. First you run the printer install program that comes with the printer itself. This will add the appropriate printer driver to your chosen application. A new version of MacWrite is being shipped with the LaserWriter, and third party programs such as Microsoft Word and Lotus Jazz are already encompassing LaserWriter support.

After you've installed the printer, you can just about forget that it's there. All the usual printout selections work as usual... with the exception of screen dumps, which don't seem to be supported.

You'll get your first thrill as soon as you power the beast. After warming up momentarily, the printer spontaneously disgorges an attractive but ultimately monotonous graphic self-test page. Finding someplace to dispose of these will probably be your major difficulty in dealing with the machine.

The LaserWriter comes with several built in fonts, these being Times, Helvetica, a symbol font and Typewriter Courier. The latter is essentially the same font used on the IBM Selectric. Italic and bold variants of most of this stuff are also included. The new MacWrite incorporates the same fonts for total compatibility.

Once your document is ready to go, the LaserWriter spits copies out about one every couple of seconds... sort of the speed you'd get from a photocopier, which is not surprising considering the similarity between the two technologies.

However, there's a catch. Any fonts not available internally in the LaserWriter have to be downloaded to it. This is also true with graphics. The printer has to generate a complete internal bit map of your final document before it can do any actual printing. This calculating process can take anywhere up to five minutes. The delay is roughly the same whether you're asking for a complex graph or just one or two odd fonts. Once the page is set, of course, copies come wafting out at their usual rapid pace.

Either way, the final print quality is phenomenal. It takes a sharp eye to tell the difference between LaserWriter and the output of a true phototypesetting machine. LaserWriter's curved letters show only the faintest hint of fuzz. Its graphics are razor sharp.

The system is convenient enough to be used for all sorts of commercial stuff... either as an upgrade from typewritten copy or as a cheaper and faster alternative to full typesetting.

Any laser printer works much like a photocopier, with the laser essentially creating an original directly on the printing drum. This means that servicing the LaserWriter is a lot like what you'd expect with an office copier, involving filling the hopper with paper, topping up the toner and cleaning the drum.

The Inside Story

Considering how well the LaserWriter fulfills its appointed mission, it is appropriate to be a bit curious about what goes on inside.

In actual fact, this printer is the most powerful computer Apple has ever built... containing a twelve megahertz 68000 processor with a half megabyte of ROM and one and a half megabytes of memory... all on a single circuit board astride the Canon laser print engine.

You might well ask why a printer needs all this hardware. A lot of this has to do with

generating high quality output regardless of the type of input the printer is given. For instance, the high resolution bit map for a single font takes up twenty K of ROM. Nine fonts are built in. Downloaded fonts will eat the equivalent amount of RAM space.

Pages are built up using a Forth-like descriptive language called PostScript. Like a lot of Macintosh technology this software is a spin off from Xerox... designed by former Xerox researchers who now run a company called Adobe Systems. Although PostScript is not the only page description language in the field, Linotype is supporting it on its own 2540 dots per inch typesetting units. Truly, the LaserWriter has more in common with a typesetting machine than it does with your average dot matrix printer.

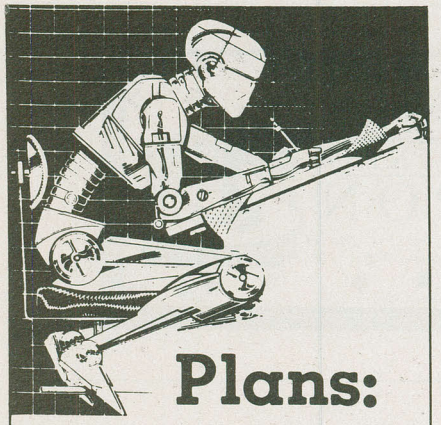
Many Mac programs... such as MacDraw... use their own descriptive syntax, known as QuickDraw. This is readily translated into PostScript form. Bit mapped graphics... such as MacPaint... are trickier to convert, but this shouldn't be a serious problem.

A sample of the LaserWriter output

The description for a single page of print will take up almost a megabyte of RAM. This leaves a half meg for downloaded fonts and other stuff. If you keep using the same fonts, the LaserWriter is theoretically smart enough to keep them in RAM. If you invoke something new... another font, or a rotated or italicized version of a one of the old ones... LaserWriter will obliterate whatever seems to be in least demand. If you keep switching through a pile of fonts, you'll force the processor to repetitively download or recalculate.

Some of the existing Mac fonts seem to print with somewhat less quality than the LaserWriter's built in lettering. The beauty of the PostScript system, however, is that it is open ended. New fonts... and other

Apple Laser Writer



Plans:

Printer:	**LaserWriter**
Print Quality:	**300 dots per inch**
Manufacturer:	**Apple Computer**
Distributor:	**Apple Canada, 875 Don Mills Road, Don Mills, Ontario M3C 1V9 (416) 444-2531**
Suggested Retail:	**$10,950**

goodies... can be added at any time. About the only thing all this machinery is not intended for is to reproduce the Macintosh screen, pixel for pixel. This explains the absence of screen dumps.

But Soft...!

Unless you're heavily into typesetting, you'll probably never deal directly with the intricacies of PostScript. Apple has been busily making changes in a lot of its Macintosh software... both to make the LaserWriter feel welcome and to generally make things easier on the user.

A whole set of update disks has recently been issued, revising MacPaint, MacWrite and the Finder, as well as adding several new utilities, such as the font and desk accessory mover.

From the LaserWriter point of view the main change is on the desk accessory pull down. You'll now find an option called *choose printer*... which we've already described. As the documentation points out, the Imagewriter is the default, so you needn't concern yourself with this unless you're really planning to pop for a LaserWriter.

There's also a new version 4.1 Finder that's supposed to be faster than the older one, with better hard disk support... and some more obvious new conveniences. For instance, file directories displayed in text form can now be manhandled exactly the same way they can in icon form. A little padlock indicates locked files. Furthermore, it's a bit easier to eject a disk. The file menu now lets you print the catalog. The special menu contains a new *Use MiniFinder* option. The MiniFinder lets you move quickly between up to a dozen applications and work files. When booted the Mac will automatically use any MiniFinder it finds, even if it's not on the startup disk.

The font and desk accessory mover is a menu operated effort that lets you shuffle all your fonts and things around without getting too confused. It'll even show you a sample of the font you've selected to play with, so you can be sure you've snagged the right one.

There's lots of good news for MacWrite users. The new version uses virtual memory to let you edit documents much larger than available RAM. You'll be able to manage up to sixty pages on a thin Mac, and several times that with a fat Mac with a hard disk. The new version will happily engulf old MacWrite files, although once it's had a go at them they'll no longer be useable with the old version. However, as Apple says, there's no reason to cling to the older MacWrite.

There are a few other novelties hidden away in the new MacWrite. Several new justification options have been added to the format menu to allow easy local changes in alignment. Find next has been added to the search menu. The scroll box displays page number, and you can go to a page number by hitting command G and that number. Also, MacWrite can now create pure text documents... useful if you want to interface with some other kind of software.

Finally, there are even some glad tidings for those three or four Lisa... er, I mean Macintosh XL... owners out there. Apple has come up with a auto loading version of MacWorks so that you can now boot directly into MacLand and bypass that nasty Lisa environment. Even more miraculous, the company has devised a hardware display fix that will actually change the shape of the XL's pixels to match those of the Mac. Now at last you can see things in the proportions that God and the software developers meant them to have. **CN!**

ArchitecturalDesign | Issue #12 | Winter

Arch News

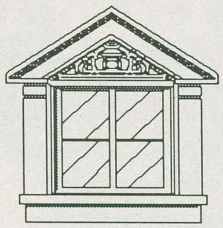
The Society of Architects
1400 New York Avenue
Washington DC 20018

Value is what the 1985 SOA National Seminar in Atlanta is about-- and it's what you'll find in greater quantity and greater quality than ever before at the convention's 1985 SOA Exhibit of New Technology and Products.

The biggest convention exhibit in SOA history will present you with a demanding challenge: Find a way to decide which products, services and technologies you want to learn more about:

Computer Technology
Software, Hardware
Contract Furniture
Interiors, Exteriors
Practice Systems

You'll find it all--plus a convention schedule that lets you see it all--at the 1985 SOA Display of New Products and Design.



The Art of the Dormer, a retrospective look at 19th Century dormers. At the Seattle Architectural Gallery through the 19th of the month.

This page was created with Hayden's Da Vinci, Aldus' PageMaker and the Apple LaserWriter.

"Architecture... has its own validity. It needs no reference to any other discipline to make it viable or to justify its value."
--Philip Johnson

Dr. Wren

Conferences, seminars, workshops:

May 21-25 25th Annual Meeting, The Society of Architects, 1400 New York Avenue, Wash. DC 20006.

June 10 Deadline, call for 500-word abstracts, "Designing and Managing Commercial Buildings: An Intensive Workshop."

June 25 American International Solar Conference and Exhibition. Thomas Convention Center, Dallas,TX.

Call (206) 555-1919 for details and register early for the 1985 SOA National Seminar

"Architecture aims at eternity; and therefore is the only thing incapable of modes of fashions in its principles."
--Christopher Wren

Master Architect

The man featured in this month's issue may well be one of Vancouver's best kept secrets. You may not know his face, but if you live in Vancouver you know his work - that is, if you've ever visited Simon Fraser University, The Museum of Anthropology, Robson Square/The Law Courts, or any of a number of other governmental, commercial and residential buildings. The man is Arthur Erickson, Architect, and he has called Vancouver home for most of his life.

While the layperson may not recognize his face or name, during a remarkable and prolific career spanning more than 30 years, Arthur Erickson has received dozens of honorary degrees and virtually every major professional and personal award. To list them all would take pages, but they include the Man of the

Guaranteed Lowest Prices!!!

Free Shipping

To Our Readers:

JMG Software would like to thank you for your excellent response! Your compliments on our pricing and support give us the energy to keep up with the expanding market. As always, we will keep you aware of new products, and only supply the latest software versions.

Sincerely,

JMG Staff!

No Charge For Credit Cards

It's Time To Upgrade Your PC

THE REAL THING

Hercules Monochrome/Graphics Card	$499.00	or
Hercules Color Card	$289.00	or
AST Six Pak w/256K	$441.00	or
Tecmar RAM Card w/256K	$462.00	or

OUR 100% COMPATIBLE SUGGESTIONS

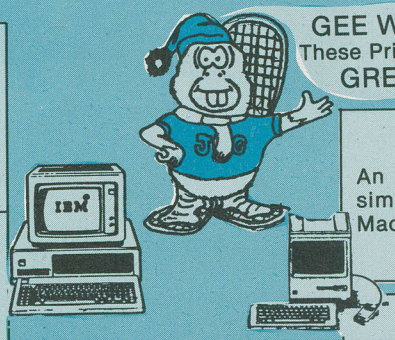
Comgraphics	$419.00
Color Card w/Parallel	$249.00
Multifunction Card w/256K	$266.00
RAM Card w/256K	$143.00

Serial Card **$79.00**
Parallel Card **$59.00**

384K Multifunction Board with 389K
1 Serial Port, 1 Parallel Port, Clock/Calendar, Gameport **$329.00**

Modem Special
SmarTEAM 103/212A Modem
Hayes Compatible
2 Year Warranty
Works With smartcom, Crosstalk
$360.00

CLIPPER dBase III compiler.
Clipper can compile your dBase III programs so they run 3 to 15 times faster! only **$599**
*no run time module is required.



AIRBORNE
An excellent new flight simulator for the Apple Macintosh.
only **$39.00**

IBM Software

Sidekick	$ 52.00
Intuit	$129.00
dBase III	$539.00
(hurry Ashton Tate is raising prices!)	
Around	$149.00
Wordperfect	$345.00
Multimate	$339.00
Reflex	$469.00
Microsoft Word	$339.00
Turbo Pascal 3.0	$63.00
Turbo Pascal 8087 (3.0)	$98.00

The 100% Canadian Company
With The Lowest Prices

LOWEST PRICES
on IBM Hard Drives

Why not Buy and Use the same Hardisk used in the new Compaq's? They can take the punishment while still offering the best realiability.

10 Mb HD w/cont.	$949.00
20 Mb HD w/cont.	$1099.00
10 Mb Tape w/cont.	$999.00

Apple Macintosh Software

Quartet	$199.00
Click Art	$ 49.00
PFS: File	$189.00
Sargon III	$ 54.00
Microsoft Word	$189.00
Mac the Knife	$ 45.00
Microsoft Multiplan	$189.00
Music Works	$ 89.00
Think Tank	$139.00
Hayden Speller	$ 89.00
Microsoft Chart	$119.00
Microsoft File	$188.00
Megaform	$269.00
Megafiler	$189.00

Mac Copy 67.00

GEM $67.00
GEM DRAW
$147.00
Microsoft Mouse
$223.00

Mac Specials

Crunch	$285.00
Helix	$339.00

RAM Disk II $45.00
Mac Bottom
10mb Hard Disk
only **$2288.00**

Free Catalog just write

JMG SOFTWARE INTERNATIONAL INC.

Prices subject to change

THE FINE PRINT:
FREE regular shipping in Canada and the U.S. Add $2.50 for COD orders (cash, certified check or M.O. only for CODs). POs accepted from schools, gov't and major corporations; $5.00 additional charge.

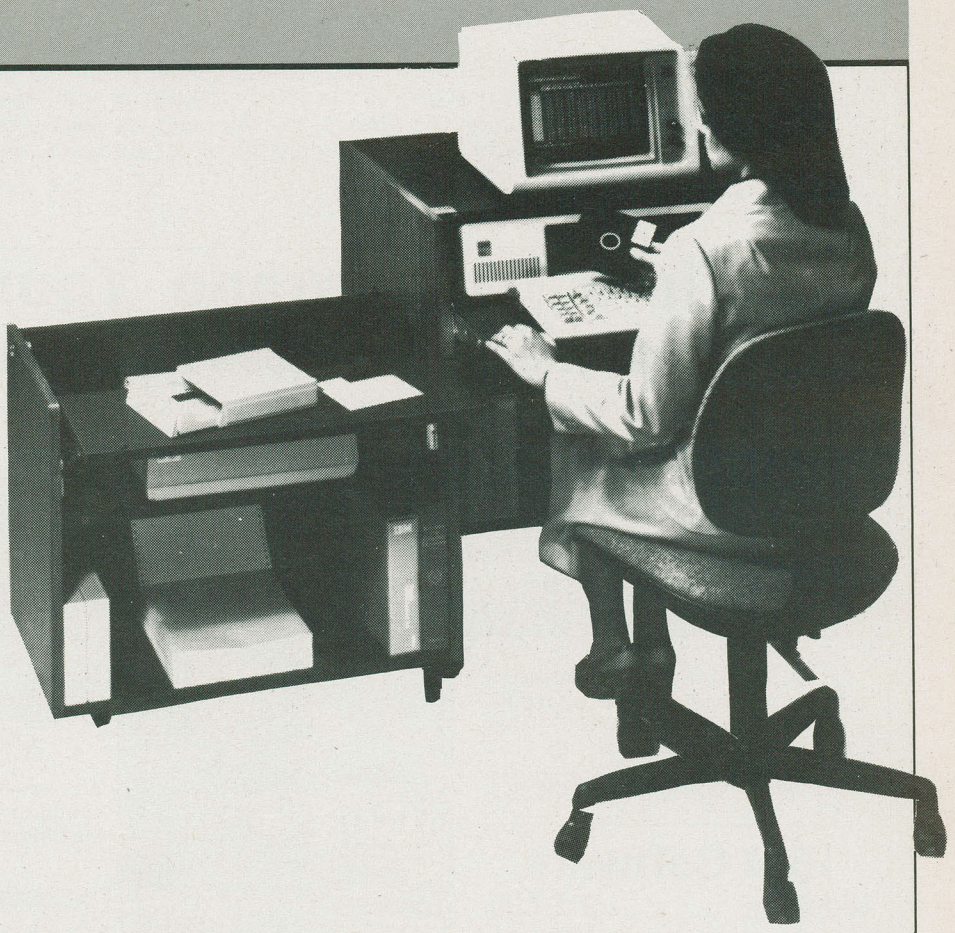
A S T RESEARCH
ASHTON-TATE
BORLAND INTERNATIONL
DIGITAL RESEARCH
DOW JONES & COMPANY
MICROPRO INTERNATIONAL
MICROSOFT
MICROSTUF
HARVARD SOFTWARE
HERCULES
INFOCOM
INFORMATION UNLIMITED SOFTWARE
INNOVATIVE SOFTWARE
MAIN STREET SOFTWARE
MEGAHAUS
NORTON COMPUTING

To Order Phone
(416) 575-2867
or write to
JMG Software International
18 Mohawk Rd. East,
Hamilton, Ont., L9C 2Z8

A News MS-DOS for Business

Local area networks are among the most powerful things in the latest deluge of high end technology. In the scramble to define a standard for LAN software, a lot of manufacturers are getting tight with Microsoft's multiuser DOS.

by Steve Rimmer



Until just the other day... well, about a year ago, actually... microcomputers were, for all practical purposes, personal systems. One always had one person for each computer, and the only way to realistically get two people on one computer was to have the second one sit on the first one's lap. This was uncomfortable for the first person if the second person was unusually fat or carried a lot of keys in his or her back pocket. As such, this promising innovation never really found wide acceptance.

More powerful computers... the IBM PC and its children in specific... got the boys in the lab coats thinking about the advantages of having multiple users accessing the same system again. The PC, for all its failings, still has a lot of power... quite a bit more than a single user is likely to need for a single application. After a lot of thought and enormous numbers of reports and papers and demonstrations to the press quite a number of companies started to get into the idea of local area networks and multiuser systems.

The crux of the biscuit, however, MS-DOS, is still very much a single user party. Quite a number of LAN designers have gotten tricky and put hooks into MS-DOS 2.0 to allow it to work in a multiple user environment, but most would have agreed that the operating system could have been a much better multiuser environment if only it had been designed as one.

There is a new version of MS-DOS, one which has expressly been designed for large scale business users, this being the oft alluded to DOS 3.1. Among other things, it has been designed to be comfortable in a real multiple user environment. It overcomes a lot of the previous limitations inherent in microcomputer LANs and makes large scale networks very much more of a contemplatable reality.

Behavior

Understanding what makes DOS 3.1 powerful probably has to start with understanding just what a local area network is. There is a difference between this and a multiple user system... which is what most people think of when you start talking about a LAN.

The IBM PC has enough power to allow it to stick two programs in memory and handle them both. With a bit of sneaky software it's possible to have it talk to a terminal through its serial port and allow the human perched before the terminal to use the second program as if he had his own computer running it. However, both programs would be running on one computer with, presumably, a common disk.

You can add lots of users this way, but as you do several things start to happen. As the PC starts to divide its time between more and more programs running at once the effect for each user on the system is to have everything start looking very slow. Secondly, as it cuts its memory into more and more chunks each user gets increasingly smaller blocks of it. Finally, if two users try to access the same file at once on a system like this, there can be some fairly hairy disasters. This is called a *file collision*.

A local area network is something a bit different... and a bit more complicated. Let's say that we have three computers which are connected together by some wires. These are the cables of the as yet admittedly unexplained LAN. The first computer has a plotter on it, the second a printer and the third a modem. The first computer is further blessed with the responsibility of being what LAN designers call the *server*.

The server runs an operating system... the LAN software... which, among many other things, knows which physical computers have which actual peripherals attached to them. The other computers, in turn, run an operating system... another part of the LAN package... which does what MS-DOS normally does but also watches for calls from the server.

Now, let's say that the head in front of the second computer wants to use the modem on the third computer. His requests for a modem would be sent by his local DOS to the server. However, the request would be of the form "I wanna use the modem" as opposed to "I wanna use the serial port on the third computer".

The modem has been reduced to a *logical device*. If you want to get access to it you have to let the server find it for you. You just treat it like you would any peripheral.

The server would look at the status of things and see if the modem happened to be free... happened to exist at all... and where

it was. It would then take the data from the second computer and connect it to the serial port of the third computer.

The important part of this is that the physical location of the modem is transparent to the users of the computers.

Likewise, users of these computers could send files to each other. Once again, you would attach an address to the file you want to send and the server would take care of where it actually wound up.

Finally, of course, a network allows for having common software and common data files. As such, you could have multiple users updating the same database.

The important thing about a LAN, as opposed to a simple multiuser system, is that each of the computers... or *nodes*... is a self-standing system. As such, each has all the power of a whole PC, rather than a fraction of the juice of a single PC with lots of wires hanging out of it.

Back to DOS

Obviously the operating system that presents itself when you boot up a LAN could be anything. There are the real die hard programmer types who would like to behave like UNIX. However, most LAN designers have realized that there is a lot of very profound karma in having the whole works appear to be MS-DOS. As such, most early LANs consisted of programs which dropped *hooks* into DOS 2.0 to make it behave like a LAN.

You can look at DOS 3.1 as being DOS with the hooks already in place. In fact, the DOS largely defines the LAN standard that is built around it. A LAN using DOS 3.1 would consist of a server, an interface *shell* and the host operating system.

Yes, I know, anything more complicated than a screwdriver generates more funny words than it explains.

The first problem with understanding all this is that we are used to thinking of a microcomputer as running a single program at a time. These three aspects of the system all run more or less simultaneously. This is a conceptual problem to be sure. You'll need a bit of faith if all this is going to work out.

You probably have a reasonable idea of the function of the server by now. It manages the flow of data around the network. It is properly called a *file server* because data is typically regarded as being chunks... files... rather than a continuous stream. If you think about it, sending a file to a printer is conceptually the same as saving a file to a disk. You can't get it back from the printer, of course.

In dealing with the server we can regard the logical device A:, a disk drive, and the logical device LPT1:, a printer, as being essentially the same.

The interface shell is a sort of a traffic cop. It decides whether what you are doing at a computer on the network will use the resources of the computer itself or the resources of other nodes on the net. There are a few obvious examples of this. If you go to save a file to drive A:, the shell will look at the request and say "hmm... drive A: is a local logical device... better send this one to the floppy".

Finally, the host operating system is something that behaves like MS-DOS 2.0. Typically this will be enhanced by commands that make using a network a bit

A News MS-DOS for Business

easier. There's a discussion of the minutiae of LANs elsewhere in this edition of Computing Now!.

What Goes Down

One of the things that tends to grab networks by the small steel bolts on their necks and wrench their heads off is the tendency of programmers to write *poorly behaved* software. This is another one of those terms like *user friendly*. If someone told you that your software was poorly behaved you'd smile knowingly and then slink off to try to find out what was going on.

WordStar is a decent example of poorly behaved software. When it writes something to the screen of the computer it's running on it does so by writing directly to the system's BIOS. Without getting into exactly what this involves... no one really wants to get all covered in greasy little bytes anyway... it means that the screen updates faster but that DOS doesn't know what is going on.

The importance of the DOS 3.1 LAN shell is that it can look at every request a program makes for data from the keyboard, disk access, a print to the screen, a dump to the printer and so on and redirect it, if necessary, to the server. This implies, however, that the program has been written to send its request through DOS in the first place.

Typically LANs get around this problem by including patches for popular packages which will improve their behaviour. However, a well behaved WordStar is a very slow thing to watch.

Fortunately, the poor behaviour of software typically extends only to how it handles simple devices, like the screen and the keyboard. Disk accesses are still done through DOS by all but the most extreme programmers. However, in this too there are some catches... it is, in fact, here that one of the major advantages of DOS 3.1 lies.

If your program goes to save a file what actually happens under DOS 2.0 is that a system call is made to DOS... what is referred to by programmers as an INT 21H... which then opens the file and writes to it. Actually, this requires several INT 21Hs. Under an older style LAN the hooks of the LAN would catch the data before it got to the disk and redirect it to the server, which would then decide where it was going to actually go.

This is terribly inefficient. The handling of data going to a real disk file is optimized for disks... and a very clumsy way of passing information to the server.

Furthermore, the way DOS 2.0 handles subdirectories makes accessing files a long way down a directory path quite slow... also a pointless interference for a server.

The shell under DOS 3.1 catches the INT 21H calls... the requests for disk activity from your programs... and decides whether the information should go to your local disk or the server. If it's bound for the server the shell saves a lot of time by not bothering with the local disk drive at all.

Caught in the Net

Inherent in DOS 3.1 is its ability to be combined with yet another package from Microsoft, MS-NET. While DOS 3.1 provides a familiar MS-DOS style environment to work in... one which is capable of supporting a network... MS-NET adds the necessary software to make the network happen.

Allowing that we have all the computers actually tied together with all the right cards and cables... once again, check out the LAN article elsewhere in this issue... MS-NET is responsible for turning all this expensive hardware into a real network.

Among the things that the server of MS-NET can do... aside from simply handling the network's data... is manage the access users of the network have to its files. Now, this gets pretty tricky, because you might well want to put things on the network without necessarily wanting everyone else to be able to look at... or modify... them.

The server takes care of the *permissions* of files and, if you want them, of whole directories. Because it knows who is at each computer on the net it also knows who is allowed to get to which files. It knows who created each file... its *owner*... and, as such, can accept specifications as to the permissions for files from their owners.

This sounds a bit complicated at first, but it's actually fairly simple. If you create a letter and put it onto the net you can tell the server who you want to be allowed to read it and who, if anyone, can be allowed to modify it.

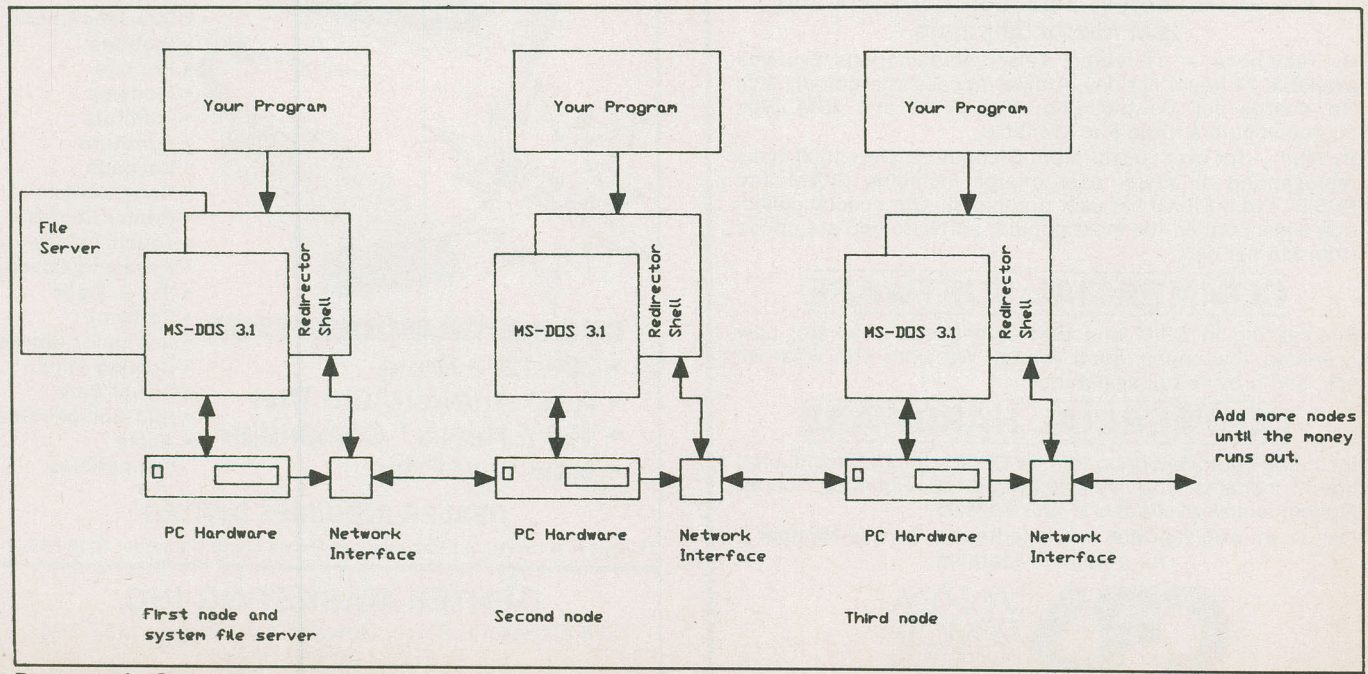


Diagram of a Lan

The important thing about MS-DOS 3.1 and MS-NET combined is that they sound extremely complicated to read about but they behave in a very simple manner. In fact, as far as the users of the computers on the net are concerned they behave just like regular old MS-DOS. About the only addition most users would need would be a sheet of paper with the new commands added by the system... you can ignore almost all of these in the normal course of using the net... and a bit of instruction concerning how one accesses the peripherals on the system.

Furthermore, because the system is really authentic MS-DOS it allows most popular software... well, any well behaved software... to be used on the net without any glitches.

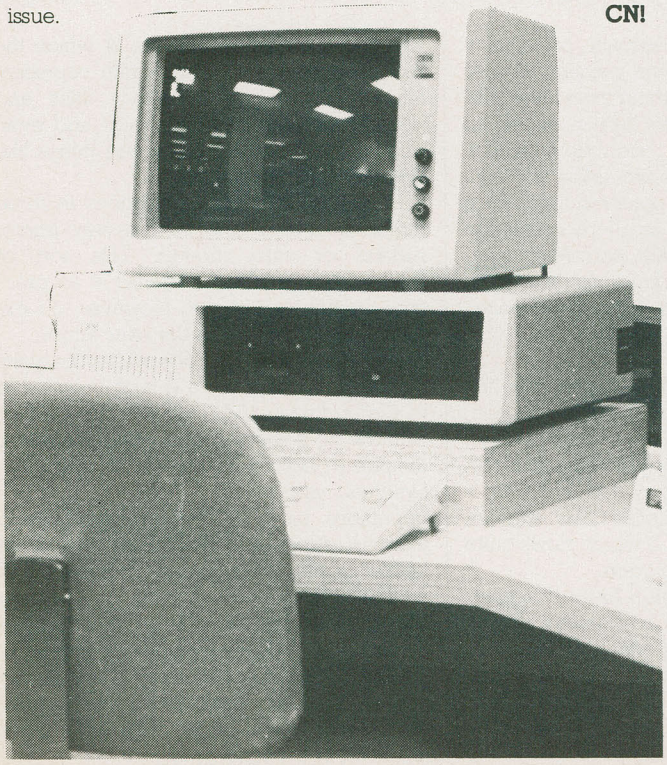
Net Worth

The power of even a small local area network is amazing... like so many other things about microcomputers, you can have no real idea of the advantages such a thing can bring to a room full of previously isolated PCs before you actually use it.

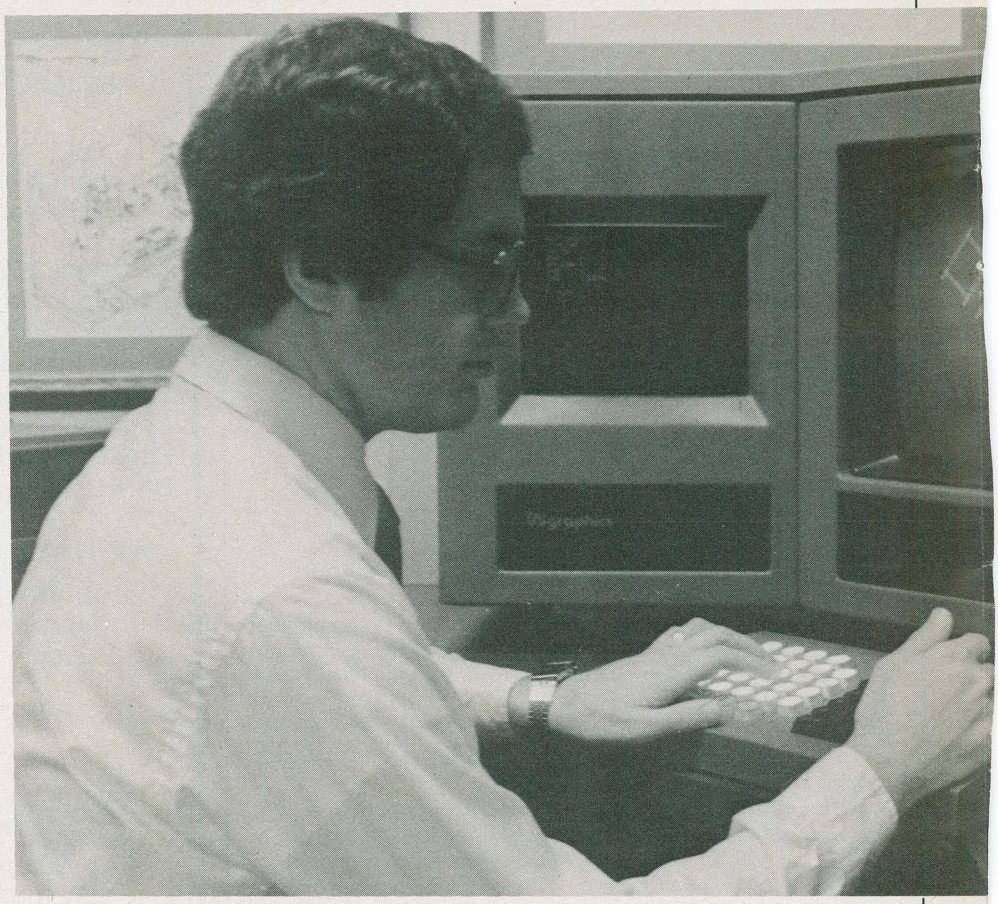
Using the Microsoft standardized network system eliminates a lot of the peculiarities inherent in some of the earlier LAN designs. It makes the system a lot simpler to get application software for and inherent in it is the potential for quite a bit of expansion.

Also built into DOS 3.1 is a whole new set of DOS calls that allows programmers to make better use of the network. As such, it's reasonable to expect that software will become available to optimize the use of a network. While a lot of this sort of thing is theoretically possible on most LANs, programmers traditionally avoid writing really complex stuff for specialized... and possibly soon to become extinct... environments.

Most of the newest generation of LANs support DOS 3.1, and many of the existing LAN manufacturers are getting into it. Aside from MS-NET there are PCNP... the IBM PC Nework... and Novell NetWare. The latter is described elsewhere in this issue. **CN!**



Of the CAD/CAM Conference



Conferences and trade shows are typically pretty dusty affairs. However, in the high tech field of computer aided design the rapid advances in the state of the art made this year's gathering pretty lively. Here's a look at where the lines were drawn.

by Frank Lenk

We who merely dabble at the keyboard of a microcomputer may have some difficulty grasping the real hugeness of CAD... Computer Aided Design. It's a whole other world, filled with its own interesting acronyms, including *CADD,* computer aided design and drafting, *CAM,* computer aided manufacturing, *CAE,* computer aided engineering, *CIM,* computer integrated manufacturing... it goes on and on.

Things have been happening fast in this parallel dimension of computing... as could be plainly seen at the Canadian CAD/CAM and Robotics Exhibition and Conference held in Toronto for three days in June, and hosted by CIM, the Canadian Institute of Metalworking. As befits an occasion with such a windy title, the Conference proved to be a massive, mind bending party. Everybody and their mechanical dog was there. In fact, this exhibition pretty much blew away such lesser gatherings as the recent computer show.

The range of equipment on display spoke volumes about the present state of CAD. There was everything from huge IBM consoles looking like they'd been swiped off the set of Star Trek III... right down to Apples running electronics simulation and control software. To really get the quintessence of the event, I attended an afternoon session promisingly entitled *PCs and Microcomputer* before doing the long hike round the exhibit booths. It was quite an experience.

Verbal Abuses

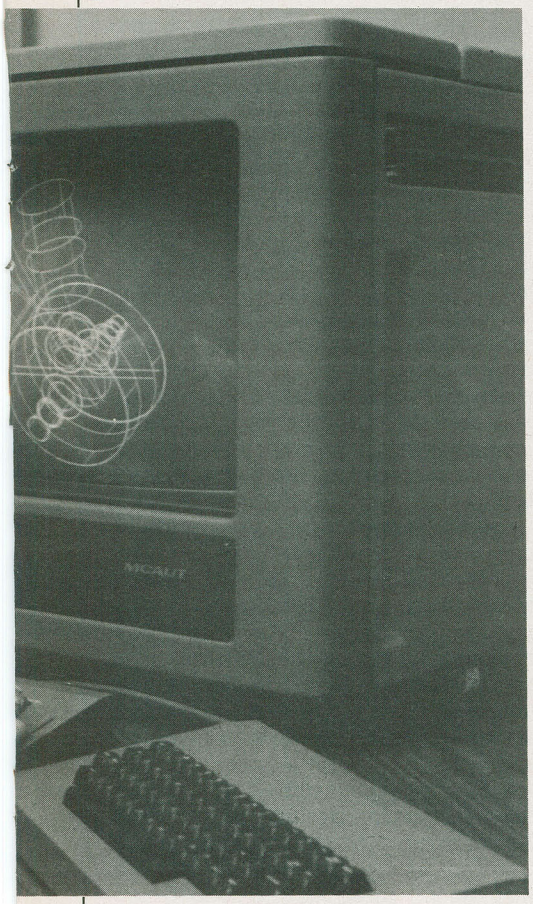
According to Leonard Pannolino, the first speaker at the Microcomputers session, about two thousand dollars worth of today's software will just about replace last year's fifty thousand dollar CAD system. The trick is that the two thousand dollar CAD software runs on the average PC, which slows quite lamentably under the burden.

Nevertheless, there's a lot of designing you can do on an only moderately expensive IBM PC. Pannolino ennumerated some of the types of application now available commercially. Design and drafting is apparently the largest area so far, represented by about a dozen software packages. A top line two dimensional system, of which the redoubtable AutoCAD is quite representative, lets you draw points, lines and shapes, redimension, insert text and even do some of the more advanced things like layering. However, it's slow.

Even slower are applications in three dimensional modelling, such as *wire frame,* surface or solid models. This sort of manipulation is not considered at all practical on micros just yet. However, it's expected that it will be in the near future.

Computer analysis doesn't get the glory that design does, but it's at least as valuable to the engineer. CAD will produce a part with the right shape, but it would be nice if the part would refrain from flying apart in its eventual application. Analysis includes operations such as *finite element* stress analysis, stress and deflection analysis of beams or structures, stresses in a pressurized shell and so on.

A finite element analysis that takes a minute on a VAX minicomputer will run for around fifteen minutes on a PC... not an unbearable wait, considering the bottom line alternative of slide rules and other medieval instruments of torture.



Kinematic analysis involves simulating the motions of mechanical systems, down to transient vibrations if you feel like it. The typical software would tend to provide both tables of numbers and some graphical displays.

A final application concerns pure instructional use. Rather than having students learning from a text book... or running rampant with a real numerical control metalworking unit... one can simulate the whole operation on a micro. One new system, dubbed McNC, for *microcomputer based numerical control*, can graphically simulate a two axis machining operation, based on an integrated spreadsheet on which the numerical control data can be entered and edited. If everything looks good in simulation the data can be downloaded to a real numerical control machine... presumably without causing said machine to cut itself to pieces.

The Shape of Things

Michael Lake of the Ontario CAD/CAM Centre had words about "the unrealized potential" of microcomputer based CAD. It turns out that there has been an... understandable... resistance to replacing three hundred thousand dollar CAD systems with ten thousand dollar micros. Yet the total market for PC CAD packages in 1984 reached over fourteen thousand installations, a value of forty million dollars.

There are now over twenty vendors offering "plain vanilla" drafting software. AutoDesk alone has sold almost twenty thousand copies of its AutoCAD system. The next three years are expected to see a fifty percent annual growth in the demand for PC based CADD packages, and a nearly one hundred percent annual growth for CAE software.

You might well ask who is buying all this software. It's not the traditional CAD users, apparently. A few who were in attendance at the seminar actually scoffed at the very idea of doing anything useful on a PC.

It seems that most of the low end CAD systems are being used by folks who previously couldn't have considered buying into CAD at all. There are enough of them now that even the larger CAD suppliers are taking the low end business seriously. For instance, MCS recently introduced a two dimensional drafting package called Anvil 1000 MD, and Computervision has come up with its own Personal Designer 3D wire frame software. Number Cruncher Systems, Macneal Schwendler and Swanson Analysis have all brought out micro versions of their mainframe based finite element analysis packages.

This movement is probably going to squeeze mid-sized stand alone CAD systems out of existence. Stand alone PCs will gradually acquire interfacing capability so they can talk to dedicated mini or mainframe CAD systems. Eventually they will help displace expensive front end graphics terminals. Local Area Networks of PCs will become more prevalent once the LAN suppliers shake all the bedbugs out of their own equipment.

PC CAD has become possible only since the debut of the sixteen bit systems, and it's become really viable only on account of cheap hard disks and even cheaper RAM. This, of course, is still not really enough for the power hungry arena of CAD.

To be sure, PCs do have some advantages. The bit mapped graphics screen is actually more practical to program than are the remote, serial linked screens on many CAD terminals. However, numerical analysis operations still tend to run ten times slower than they would on something like a VAX 11/780. The latest generation of PCs, such as the IBM PC AT, promises to improve the performance of CAD software considerably.

Electronics is kind of a special area for microcomputer software. Terry Zimmerman, the vice president of FutureNet Corporation, discussed some of the principles behind his company's new schematic capture program. He emphasized the need for a flexible underlying data structure. This enables the designer to display a circuit in many ways, to wit, as a schematic, an actual parts layout or even an itemized parts list.

Zimmerman also examined the evolution of translator links between micro and dedicated CAD systems. Simple file transfer will allow micros to take advantage of big storage systems. Net list translation will permit the engineer to upload new designs or edit old ones by submitting a *net list*. In its simplest form a net list is simply a list of the connections that form a circuit.

Drawing level translation has yet be thoroughly worked out, but it would permit complete CAD graphic files to be flung about freely among all the systems. Unfortunately there is still no clear standard for drawing files, although candidates, such as the EDIF electrical design interchange format, do exist.

Speaking of standards, I ought to mention another one you might be hearing a lot more about, this being *MAP*, the manufacturing automated protocol. According to the fact sheet laid on me by the Canadian Map Interest Group, this is being put forth as the communications standard for linking CAD/CAM systems, numerical control machines, robots and any other reasonably smart hardware you could find around a factory floor. It may be a while before regular humans need to know this, but then these things do have a way of spreading.

One other speaker, Tom Peterson, of Ex-Cell-O Corporation, gave a highly idiosyncratic view of how PCs can be used to integrate an actual manufacturing operation. Faced with a declining demand for its unique double enveloping worm gears, Ex-Cell-O had to boost its efficiency. They did it by sticking a standard IBM PC onto each of their numerous numerical control metalworking machines.

Direct numerical control is an established fact in today's factories, but a general purpose micro like the PC is commonly considered overkill for the application. However, Ex-Cell-O has used the PCs to allow part cutting data to be downloaded directly to each machine from the central CAD/CAM system, thereby eliminating all sorts of paper shuffling and the accompanying opportunities for error.

Ex-Cell-O had to design its own interface boards and software. Furthermore, the

Of the CAD/CAM Conference

company managed to solve the non-trivial problem of translating its mainframe CADAM standard drawings to something that could be displayed on the PC stations. The shop floor PCs each have a half megabyte of RAM, one floppy drive and an Epson printer. Ex-Cell-O is now planning for the complete control and monitoring of its production processes and inspection.

The case of Ex-Cell-O seems to be typical of a new mood in many engineering and manufacturing circles, where the PC is being embraced lustfully. If you've ever had anything to do with engineering or the plant environment, you just can't help but be a bit blown away.

Show and Tell

Following this rather enthusiastic exposure to the wonders of micro assisted manufacture, I was well prepared to tour the actual equipment show, or so I thought. What I didn't bargain for was the overwhelming vitality, a feeling we're tending to forget out here in the world of mundane home and office computing. These folks are doing hot stuff, they know it... and they're excited about it.

Of course all the big guns were there, including IBM, Applicon, Intergraph, MDSI Schlumberger, Calma, Computervision and more, definitely not necessarily in that order. If you're into graphics this stuff can swiftly have you drooling down your necktie. Not to dwell on it, but Computervision... for instance... had a system that can display a multicolour shaded solid rendition of something complicated...like a car... and then pan an x-ray window over the image to show a skeletal view. It will then zoom in at will on anything that looks interesting.

The first item of good news was that if you are already into AutoCAD, you're state of the art. There is much talk of competing systems, but AutoCAD seems to be the one that has achieved WordStar status in the real working world. You could tell this from... among other signs... the number of hucksters attempting to flog either AutoCAD itself or some demented new add on for it.

None of the add ons was more demented than VoiceLink, developed by Voice Works of Woodbridge, Ontario and eagerly distributed by MicroCAD Systems of Concord. VoiceLink materializes itself as a rounded white box about twice the height of the average modem. This doohickey... plus a software pre-boot... lets you program a five hundred and twelve word vocabulary of spoken commands to suit virtually any commercial piece of software. The demonstrator was a wild eyed headset jockey who took great delight in standing twenty feet away from his PC and telling AutoCAD to "zoom... pan... zoom".

MicroCAD also sells some well recognized software products, such as the ubiquitous AutoCAD, smArtwork, 3D Graphixx CADD, CAD Master and others. I probably failed to note all of the local CAD outfitters, but I know that the list also included Computer Scenographics of Toronto and Computech Micro Design of Mississauga.

These dealers are mainly involved in the sale of American products... MicroCAD's tie in with Voice Works being one exception. Another such exception was Cymbol Cybernetics Corporation, which has its home in Ottawa. Cymbol has come up with a system it calls MultiDRAW, featuring two dimensional and basic three dimensional drafting functions. The new PC AT version supports designs with up to seventy-two layers, over four thousand colours, automatic dimensioning, wire frame representation, rotational and perspective viewing, multiple text fonts, bill of materials analysis plus your obvious drawing operations.

Then there's ECAD, the engineer's computer aided drafting program offered by the ECAD Marketing Corporation of Maple Ridge, BC. Although fairly conventional in approach, ECAD does seem to promise amenities such as instant zoom and pan without a line by line redraw, unlimited layering, area calculation, automatic scaling, automatic parallel lines and more.

An odd entry indeed is CadMac, from Cadmus Systems of Lowell, Massechusetts. According to the blurb, CadMac is "a powerful supermicro workstation" based on the 68000 processor, running UNIX, and communicating over Ethernet... and AppleTalk. Apparently the CadMac emulates the Macintosh environment on its own dedicated workstation, also allowing users to connect up to the Mac's own networking system. In fact, CadMac can act as a file server for the network, with up to a gigabyte of disk storage.

If that's not your cup of apple juice, you might prefer DASH, the electronic designer's ultimate orgasm. Produced by the already mentitoned FutureNet Corporation, DASH not only lets the user draft schematics, it also captures design data and generates net lists, bills of materials and design check reports. DASH further offers STRIDES, the structured interactive design system, that lets you set up a drawing tree with up to ninety-nine levels to database all the drawings in a complex design. If changes are made to any one level, STRIDES will automatically justify them throughout the other levels.

DASH also offers CADAT, a logic simulator that lets a designer verify the performance of circuits with up to ten thousand gates, or up to one hundred

The Third Computing Now! Giveaway

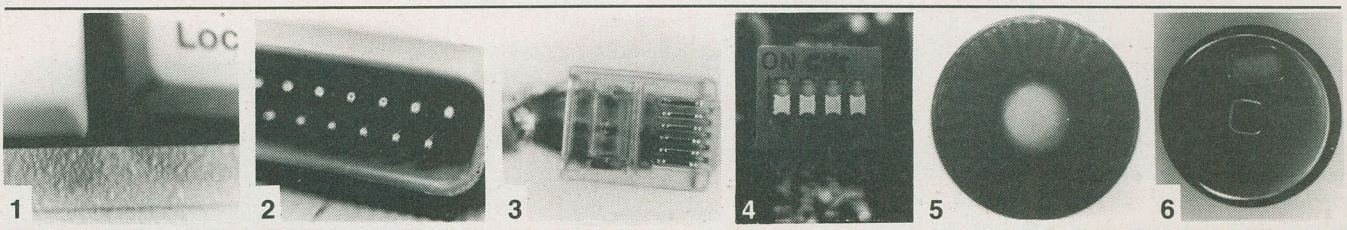
MINOLTA

The camera is, of course, one of Western civilization's great hard copy devices. While it can serve as a sort of emergency screen dump in a pinch, it has so many other incredible applications. It's able to record the faces of loved ones whether you love them or not, stop action, make usually outgoing women blush and hide behind things, preserve precious moments for a lifetime or a lunch time . . . your choice. .. and, most important, make people think you're a tourist in your own back yard.

The simple camera is well within the grasp of almost anyone. However, no one really wants a simple camera. What we're all after is one of those processor controlled, aperture preferred, automatic focussing, high speed icons of technology that people use in movies. If your brother-in-law can understand it he'll want to borrow it, after all, and you'll be using the box Brownie again before you know it.

This month's prize is, not surprisingly, the camera of the gods. It's the Minolta Maxxum single lens reflex 35 millimeter camera, and features autofocus as well as a sophisticated metering system and countless other brilliant examples of the state of the art. It has the ability to both make actually using it breathtakingly simple and watching it in use appear mind bogglingly complex for your brother in law's sake.

This month's Computing Now! giveaway, in keeping with the nature and general splendor of the prize, is based on photographs. As you'll see, there are six of them here . . . aside from the one of the camera itself, which doesn't count. It may not be apparent exactly what they are photographs of. This is intentional. All we're going to say is that every one of them is a very close up shot of some part of something related to computers.



In order to enter the contest you have to identify four of these six pictures correctly. You don't have to identify the hardware these little tree toads were part of, so long as you make it clear what they, themselves, are.

Please send us one entry only . . . we get a lot of mail for these contests as it is. Much of it is from the pulp and paper workers out in British Columbia, who tell us that they haven't killed so many trees since the last time the Globe and Mail ran a "spot the cabinet minister's brain" contest.

The camera will be given to the owner of first correct entry we draw from the contest entry Mack truck. Entries must be received and in the truck prior to September 1, 1985.

Blast your entires off to . . .

Third Computing Now! Giveaway

25 Overlea Boulevard, Suite 601
Toronto, Ontario
M4H 1B1

All entries become the property of Moorshead Publications. None can be returned. We reserve the right to announce the name of the winner in our publications unless it is that of a poodle. The prize must be accepted as awarded. The decision of the judges is final. All entries must be postmarked before September 1, 1985. Void where prohibited by law, although we don't know of anywhere where this is the case. Employees of Moorshead Publications, their families, their advertisers, their advertiser's families and owners of 1963 Rolls Royces Silver Clouds with racing stripes are not eligible to enter this contest. This contest is run in strict compliance with all known rules and regulations concerning the operation of contests, lotteries and games of chance in Argentina although, not having been to Argentina since the last revolution we don't actually know of any. We continue to seek more fine print for contests . . . anyone able to come up with some is invited to contact us.

Of the CAD/CAM Conference

thousand gates using the optional VAX link. CADAT includes a library of over ninety primitives such as MOS and CMOS transistors and transmission gates, buffers, inverters, registers, adders, RAM, ROM and much more of the same. DASH CADAT runs on a one megabyte 32016 add on processor. An optional forty megabyte hard disk uses ten megabytes to emulate an XT and the remaining thirty purely for simulations.

I should also mention some of the systems hailing from Silicon Graphics, a California based company. Although the IRIS Series 2000 is not strictly speaking a microcomputer, there is a 68010 processor buried somewhere in its knee high credenza style box. The interesting thing about the IRIS is the way it uses two custom VLSI chips... the "geometry engine" and the "geometry accelerator"... to graphically outperform systems theoretically containing a whole lot more computing power. I saw the IRIS system run an unbelievably realistic flight simulator on one display, a rotating shaded colour image of a futuristic city on one window of a second screen and a rotating wire frame image of an F15 fighter on a second window on the second screen... all without even breathing hard. All the images are calculated in real time, not merely recalled from storage.

The Silicon Graphics IRIS is probably the shape of things to come in graphics. It's worth noting that this system sells for between sixty and one hundred and fifty thousand dollars... peanuts, in this league. It provides resolution of 1024 by 1024 pixels, with sixty hertz refresh, and eight bit planes, expandable to thirty-two. There's lots of software, including the UNIX operating system and the IRIS graphics library.

Strangely enough, IBM's latest top end rendition of the PC also uses some dedicated chips to put out hot graphics. The 3270 PC connects to a wide, flat box called the graphics controller, containing dedicated graphics hardware and capable of producing a 1000 by 960 GX display or a 720 by 580 G display. IBM has just introduced an AT version of the 3270 PC, and has also added a *GGXA* graphics package. GGXA can display CADAM and other mainframe standard drawings and is also fully AutoCAD compatible.

Nuts and Bolts

To finish up I'll come full circle and spend a moment with HH Roberts Machinery, based in Mississauga. Where IRIS is sort of the ultimate graphics waiting for an application, the system offered by Roberts is pretty much the ultimate CAD application even though it skimps on graphics. Based on sophisticated Sharnoa NC cutting machinery, the overall system works much like CAD, but instead of just plotting on a screen, you can actually cut the part right on the spot.

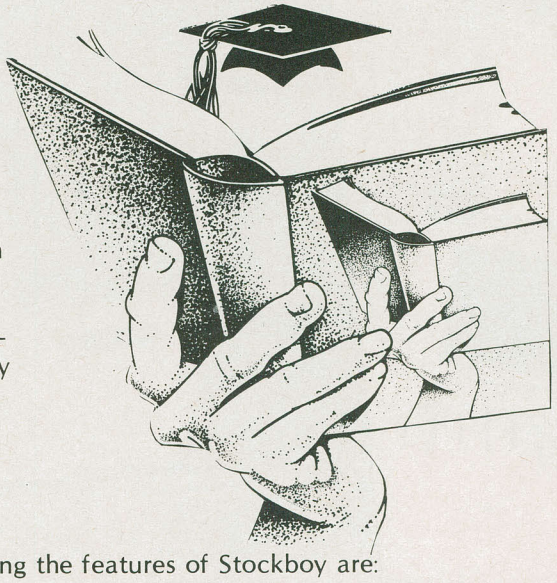
A stock IBM PC handles math, and a system hung, on the side of the Sharnoa uses the PCs math model to position the cutting head, calculating its distances in real time.

A second machine can be set up with a probe instead of a cutting bit, and will then pick up data points off a mock up of the desired part. The PC calculates smooth curves from the points and the second Sharnoa munches out a metal part. The PC can also be used to simulate... and edit... the operation graphically.

Obviously, a lot of this stuff is going to stay well hidden away in the oil stained recesses of anonymous metalworking plants. Still, it gives you a new perspective on the state of the art when you see both the highly practical factory folks and the suit and tie engineering staff grabbing onto that familiar IBM PC... and putting it to some wildly different uses. **CN!**

$tockboy*

the lowest cost, flexible inventory control program for the IBM PC, Apple II+ (with Z80 card) and CP/M



If you're involved with managing stock, handling inventories or just counting the tins of beans you have on your shelves you're probably already aware of how much a computer could help. However, commercial inventory control packages are expensive and inflexible. They usually only run on very large, costly computers. You'll need a three year course in astrophysics to learn how to use one.

Stockboy is the inventory control package for people who want to run their businesses... not their computers. It can be mastered in a quarter of an hour by a gorilla or, if you're fortunate enough to be a human being, in rather less time. It explains everything in simple English and delivers clear, easily understood reports when ever you need them.

And, perhaps most important, it costs about as much as a box of disks.

Among the features of Stockboy are:

- Inventory database maintenance with current maximum and minimum stock.
- Notification when the stock of any item drops below a user defined minimum.
- Point of sale terminal function.
- Packing list / receipt generation.
- Generates a customer list to be used in mass mailings.
- Simple, user friendly menus
- Clear, full screen editor and display

Stockboy is written in lucid... portable... Microsoft BASIC. It will run under MBASIC, BASICA, GW-BASIC, BASIC-80 and most other versions of BASIC as it stands, or you can compile it with BASCOM to make it even faster and more compact.

The package includes a complete set of readable source files. While Stockboy can be run as it is for most applications, having the source allows you to change it if your situation is a bit unusual. A complete discussion of the package appeared in Computing Now! magazine... the back issues are available.

Stockboy is the most cost effective inventory manager there is. What's more, we can provide it for systems running PC-DOS, MS-DOS, and virtually all CP/M formats, including eight inch SSSD and Apple CP/M. The cost is only:

$29.95

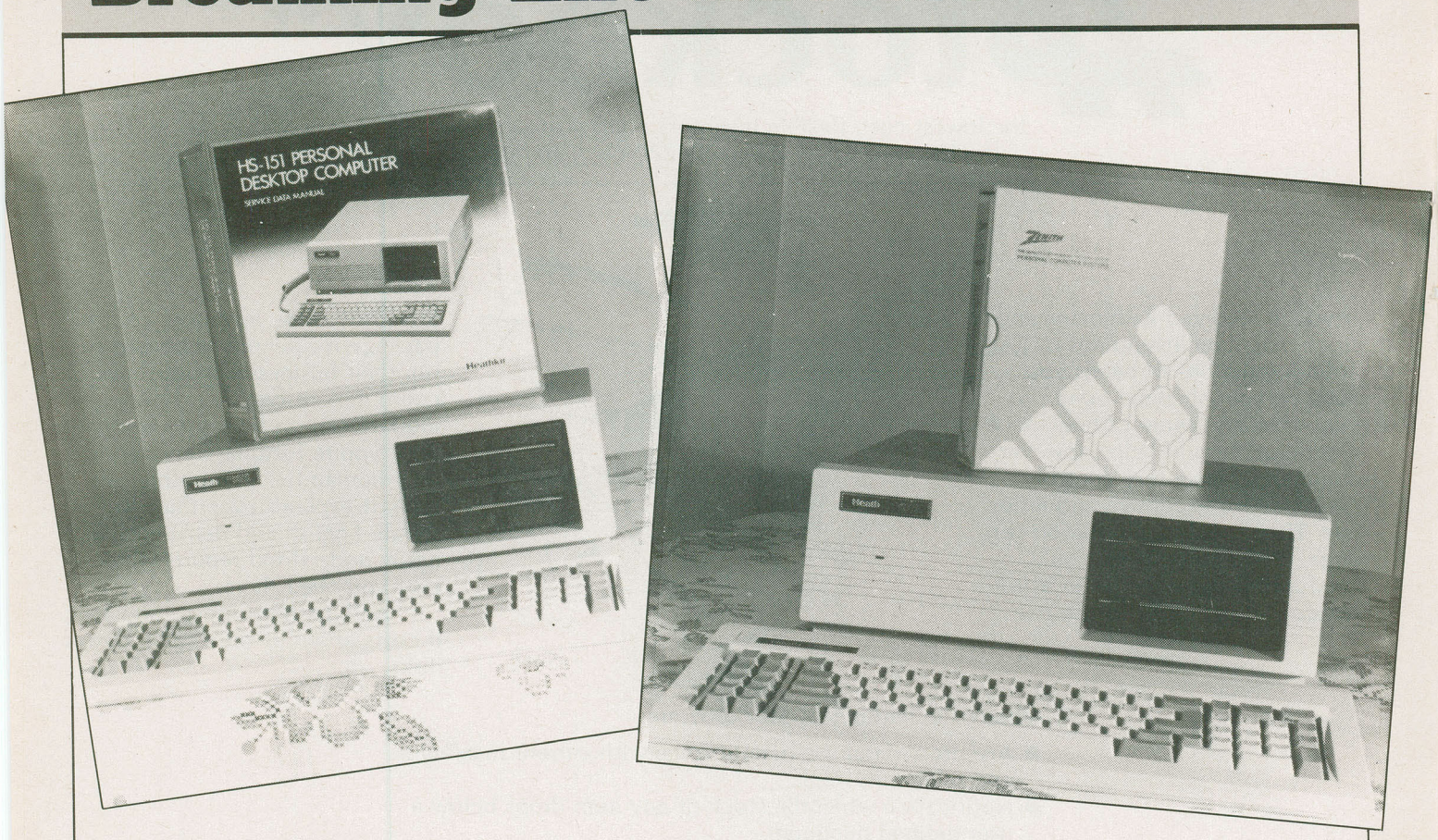
(Ontario residents please add seven percent)

A complete set of the back issues of Computing Now! that discussed the Stockboy software in detail is available for $14.95.

Software Services
Moorshead Publications
25 Overlea Boulevard, Suite 601
Toronto, Ontario M4H 1B1

or order by phone at **1-416-432-3262.**
Please have your Visa, Mastercard or American Express card ready.

Breathing Life into the HS-151



The Heathkit HS-151 is a powerful PC compatible system which comes in kit form. If you don't know this when you open the packing box you'll think you have the transit damage claim of the gods. We will now have a look at the assembly and subsequent quickening of this unique machine.

By Bruce R. Evans

The death of my eight year old 8080 based Sol 20 left me in a quandry. In seeking a replacement for it I had eight bit CP/M systems and the newer sixteen bit machines to choose from. Then there were things like MS-DOS and Unix to contend with. Finally, there was the consideration of whether to buy a fully built computer or to assemble one from a kit.

Only the last answer came easily. Certainly many Z80 based word processors are faster than most sixteen bit ones. However, in abandoning eight bit computers there was a good argument for really being state of the art and getting a really powerful processor, such as the 68000s in the Macintosh and the AT&T.

An MS-DOS based machine seemed like something of a compromise between these two extremes. However, deciding which one to buy wasn't easy.

Fortunately, at about the time I was deep in the decision process Heathkit-Zenith had just released their IBM compatible HS-151. Several people whose views I trust had the assembled version and were ecstatic about it.

Resistors

The HS-151 is among the most IBM compatible computers available. Every program that I've ever wanted would eventually prove to run flawlessly on it when I'd finished putting it together. It features both serial and parallel ports as well as monochrome and RGB color monitor outputs.

However, one of the things which attracted me was that it was available as a kit, something which is actually almost unheard of among creditable PC compatible manufacturers.

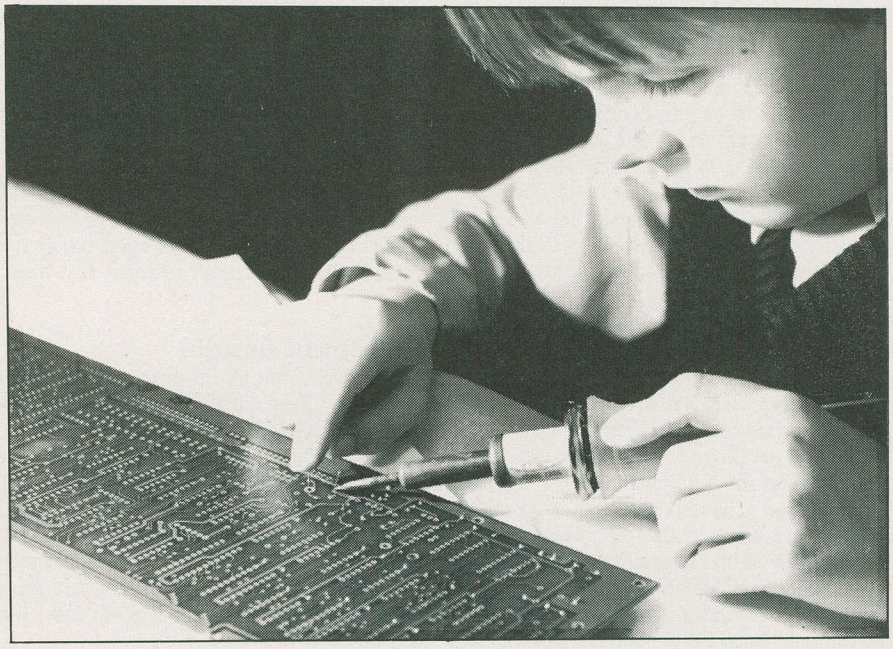
There were, for me, several desirable aspects in building a computer from a kit. First of all, the kit was six hundred dollars cheaper than the assembled version. Since it took me nineteen hours to build, I figure I made almost thirty-two dollars an hour. That's a heck of a lot more than I get for writing.

Secondly, when you buy a kit, Heathkit includes its technical manuals and a diagnostic disk. This is worth four hundred dollars. You also get half off any three software packages in their catalogue. If you like expensive word processors, spreadsheets and data bases, this will save you a bundle.

Finally, there's the real reason: I like tinkering. In building the kit I learned about what was inside the box.

"Okay," you mutter, "so you like kits. I'm all thumbs and make a Woody Allen character look competent. What about me?"

You have two choices. First, Zenith makes an assembled version of the HS–151 called the Z–100 PC. That's a cop out, though. Anyone can build a Heathkit. My eight year old son helped me with this one. I don't mean he just plugged in my soldering iron or repeatedly ran to the fridge to replenish my beer. No, he actually helped me organize the parts, inserted them into the board and then soldered them there.



The two thousand dollars I did spend on the computer bought quite a bit. My system came with three hundred and twenty K of RAM, two three–hundred and sixty K floppy disk drives, serial and parallel ports, a monochrome video output and RGB video output.

The keyboard is almost as good as the one on my Sol. There are LEDs on the number and caps lock and the shift key is in the right place. You can toggle off the keyboard click by pressing *alt* and *esc* at the same time. All the keys repeat if you hold them down. There's even a simple modification for the power supply that lets it run on two hundred and twenty volts.

I needed a wheelbarrow when I picked my system up. Most of the computer came in one monstrous cubic meter carton. In addition, there were two Shugart drives in separate styrofoam cartons and three memory upgrade kits in brown envelopes.

To further fill my Jimmy, there were three IBM look alike manuals in a box. These contained MS–DOS, the diagnostics disk I mentioned before and an operating manual. By this time, I was looking for some rope to tie the rest of the package to the roof

Like They Had Eyes

As soon as I opened the big box I knew I had a Heathkit. The organization was overwhelming. On top was the standard manual that started with unpacking the box and continued leading you by the hand until your system was running. Each section, the backplane circuit board, the controller board and the memory board, were packed in separate bundles.

There was even a package to show you how to assemble and solder electronic components. It included a practice printed circuit board, sockets and miscellaneous components. It guided one through sorting the components, packing and soldering the boards and then testing, removing and replacing some of the parts.

Even if you've never assembled a kit before, you'll be experienced by the time you've finished this portion. My only complaint was that all the solder was packaged in this section. Since I disdainfully by-passed this section, I didn't find the solder until I was half way through the kit. As anyone familiar with Heathkit knows, it's a cinch for beginners but a trap for the experienced.

Another innovation was the use of "taped components". If you've ever built a Heathkit project, you'll remember the boring search through loose resistors, capacitors and diodes. Well, find and identify no more. Now these components all come taped together in the order that you use them. If you're a real fusspot, you can check them against the list, but you don't have to. This lops hours off your assembly time.

The first board you have to assemble is the backplane. Heathkit doesn't use a mother board. Everything including the processor card plugs into a slot. This makes servicing the system much easier and also leaves the way open for an upgraded CPU in the future.

Unfortunately, this was the worst part of the entire kit. The printed circuit board wasn't up to Heathkit's usual standards. The solder mask was poor. I particularly noticed this since there were eight eighty–pin connectors to solder in place. I normally never have problems with solder bridges and poor connections. I certainly did on this board. I'm sure I spent twice as long as necessary because of the problem.

There were other annoying aspects to this stage of the assembly. For example, I had to install a large wire wound resistor between two capacitor holes. It wasn't until the end of the manual that I learned that this capacitor was just a temporary component, to be thrown away after the power supply was tested. If I'd known that, I'd have certainly installed it differently. Finally, there were a lot of unused capacitor holes on the board. This isn't really a problem but it does leave you wondering if you stuffed all the components without forgetting any.

I finished the board in two hours.

There are a number of useful techniques to bring to bear on a kit. As any experienced builder will agree, the main source of trouble in one of these things is poorly soldered joints. I use a magnifier with a built in flashlight to check the foil side of the board. You can buy these for a couple of dollars at a stamp collector's supply store.

The other big problem is caused by tiny drops of solder causing bridges between the traces. Often it's hard to tell whether you're looking at spattered solder or just flux. Even a magnifying glass doesn't always help. You can avoid this problem by using a toothbrush. Aside from keeping your dentist happy it can be used to brush off the foil sides of your boards. A soft nylon toothbrush makes a great brush. It won't build up static or harm the delicate traces.

Next I assembled the memory board. Fortunately, it was a better board. Alas, though, there were a few minor problems. I had trouble mounting the support bracket for the parallel port. The nylon screws didn't

Breathing Life into the HS-151

fit the holes in the board very well. Later, after all the components were installed, my manual instructed me to install a small capacitor on the foil side of the board. This wasn't terribly hard for me, but certainly a novice could have problems with solder bridges and short circuits. Worse, the capacitor could be knocked off while installing the board. The engineers could have done a better job here.

I disagree with one of the instructions for assembling the memory board. You're told to install all the memory at this stage. I preferred to install just the basic hundred and twenty-eight K until I knew the system was running. That way, I had less to check out and when I had the machine running, I knew that any problems that developed after I added the remaining RAM had to be in last three rows of my memory board.

Finally I approached the disk controller board. This embodied a very rare creature, a mistake in the Heathkit manual. On page 33, the instructions tell you to install resistor pack RP506 twice. Obviously this isn't really devastating, but I did spend a few minutes trying to locate the extra resistor pack before I realized there wasn't another one.

This board wasn't difficult, but once it was finished I had to install test points for later operational tests. To do this, you're told to wrap some of the cut off resistor leads around some of the leads of components already soldered to the board. Then you solder them in place and bend the ends. The finished board looks like a field of aroused cobras. It's too easy to knock these abominations off or to push them down causing short circuits.

Real solder pins would have been much more elegant.

The other three circuit boards, the CPU, video and keyboard, came assembled. This saves a lot of time and cuts down the risk of errors. So too, the keyboard and power supply came ready to be installed.

Putting the chassis together was straightforward. In particular, my son enjoyed heating the brass inserts and pushing them down into the plastic bushings on the front bezel. I had no trouble installing the two disk drives. I didn't buy a hard disk so I don't know how difficult it would be to install but I can't see a problem with it. I'll probably replace one of my drives later with a hard disk as soon as prices drop a bit more, so I guess I'll find out soon enough.

And Now, the Smoke

With the construction phase of the computer's assembly complete I got on to its diagnostics. This entails having a voltmeter and this may be a problem. The manual started off with a long winded description of how different types of meters give different results. It all boiled down to the difference between high and low impedance instruments. However, you're not told how to tell which type you have. From experience, I know mine is a low impedance antique. In fact, it's so old that it's marked in Roman numerals. However, even here I wasn't out of the woods.

Every chart for resistance testing had lots of exceptions but no explanation of what a "reasonable error" was. If I were doing it again, I'd be tempted to jump over this section and trust that my soldering was sound. In fact, I cheated. I went to the technical manual and used an oscilloscope to adjust the disk controller board. However, if you have access to a reasonable digital meter you shouldn't have any problems.

On the other hand, the voltage checks of the power supply were easy. All I had to do was watch the five LEDs I'd installed on the backplane circuit board. These LEDs are one of the many diagnostic aids that constantly monitor your system when it's up and running.

The operational checks, which come next, are a mixture of simplicity and complexity. I found programming the two switches on the CPU board confusing. These tell the processor how much memory and how many drives you have. They also give it information for automatically booting the system disk. I finally shut the instruction manual and went to the technical manual again where all the information was clear.

Once again Heath uses LEDs to help one tell if everything's working. There are six of them on the CPU board to show if the ROM, RAM, controller board and keyboard are all functioning properly. If a board isn't, the LED remains lit after the resident diagnostic power up test has run.

Having gotten to the stage where one has a monitor to look at, the computer can offer more verbose diagnostics, such as "no keyboard code received" or "disk error or bad disk controller."

At this point the diagnostics get interactive. The first set of tests are in ROM. These include tests of the keyboard, the disk drives and the memory. The memory test is quite extensive and quite slow. It took ten minutes to cycle through the full three hundred and twenty K once. Whenever I wanted to check all five hundred and seventy-six K, I just started the test and went for a long dinner.

The next level of diagnostic checks come on the diagnostic disk. These will check the drives, the I/O and most of the other parts of the system. They're very descriptive and can usually narrow down the problem to a specific chip. These are what the repairman uses when he charges you a hundred bucks an hour to fix your machine.

You should run these tests repeatedly for a week or so to see if something breaks down. As with most electronic equipment, a computer should fail in the first few weeks or not at all. However, the machine actually runs a short diagnostics routine every time it powers up. You won't see some of the action because the eleven diagnostic LEDs are inside the case. However, if there's a problem, you have only to take off the lid to find out what's gone amiss.

Heathkit's power up diagnostics don't take as long as those on the IBM PC. Part of this speed comes from how the system memory is tested. More correctly, it comes from not testing it at all. Instead, the program tests the first and last sixty-four K of RAM. These are the areas needed for the operating system so if they work, at least you'll be able to boot up the system. For this reason, I run the longer memory test weekly.

The Small Bundle

So far I've spent all my time talking about hardware. You might well ask what programs do you get with the HS-151. Actually, you don't get much. Included are Microsoft's MS-DOS versions 1.2 and 2.1 and you do get the diagnostics disk. However, that's it. There's no BASIC and no assembler. Likewise, the software bundles that many PC compatibles offer, featuring applications software, are lacking from the Heath.

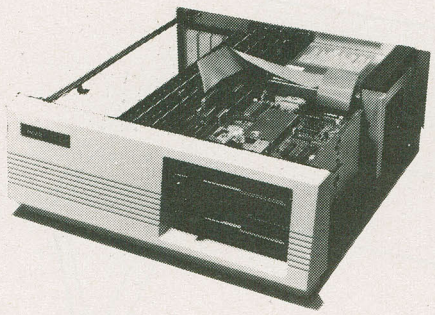
Fortunately, Heathkit carries both Microsoft's GW BASIC and a programming package that includes an assembler with some associated utilities. I haven't found any program written for IBM BASIC that won't run with GW BASIC.

However, there's a neat program included on the MS-DOS disk. It's called RDCPM.COM. It'll convert CP/M text files to MS-DOS ones. Of course this still leaves the problem of getting those files into the HS-151 if your disks aren't compatible.

When the Dust Cleared

Having finally wound in the last bolt and lost the packing material, the Heathkit HS-151 has proven to be a great computer. I've got it loaded with 576 K RAM which allows me to create and use a large RAM disk.

I've installed a Quadram multifunction board to give me all that extra memory.



There was no conflict with the memory on board the HS–151.

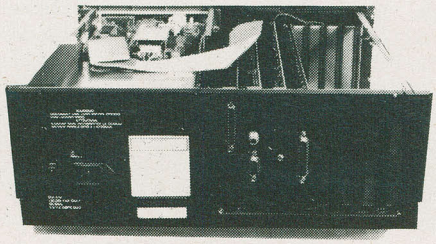
I've found only one program that ran on an IBM PC that wouldn't run on the Heathkit HS–151, this being one which tried to access the BASIC ROMs that live in a genuine IBM. However, this is hardly a real problem and, besides, it also plagues almost every other compatible system available.

There are a few problems with the system, although they're relatively inconsequential. Although the keyboard runs rings around that of the real PC, it still is the weak point of the HS–151. I'll never know why anyone would combine the cursor arrows with the numeric keypad. I always forget to turn the numeric lock key off or on. This is particularly annoying if I'm using the autodial function on my modem. It's only after I've torn the thing off the wall that I notice that the number lock key isn't glowing.

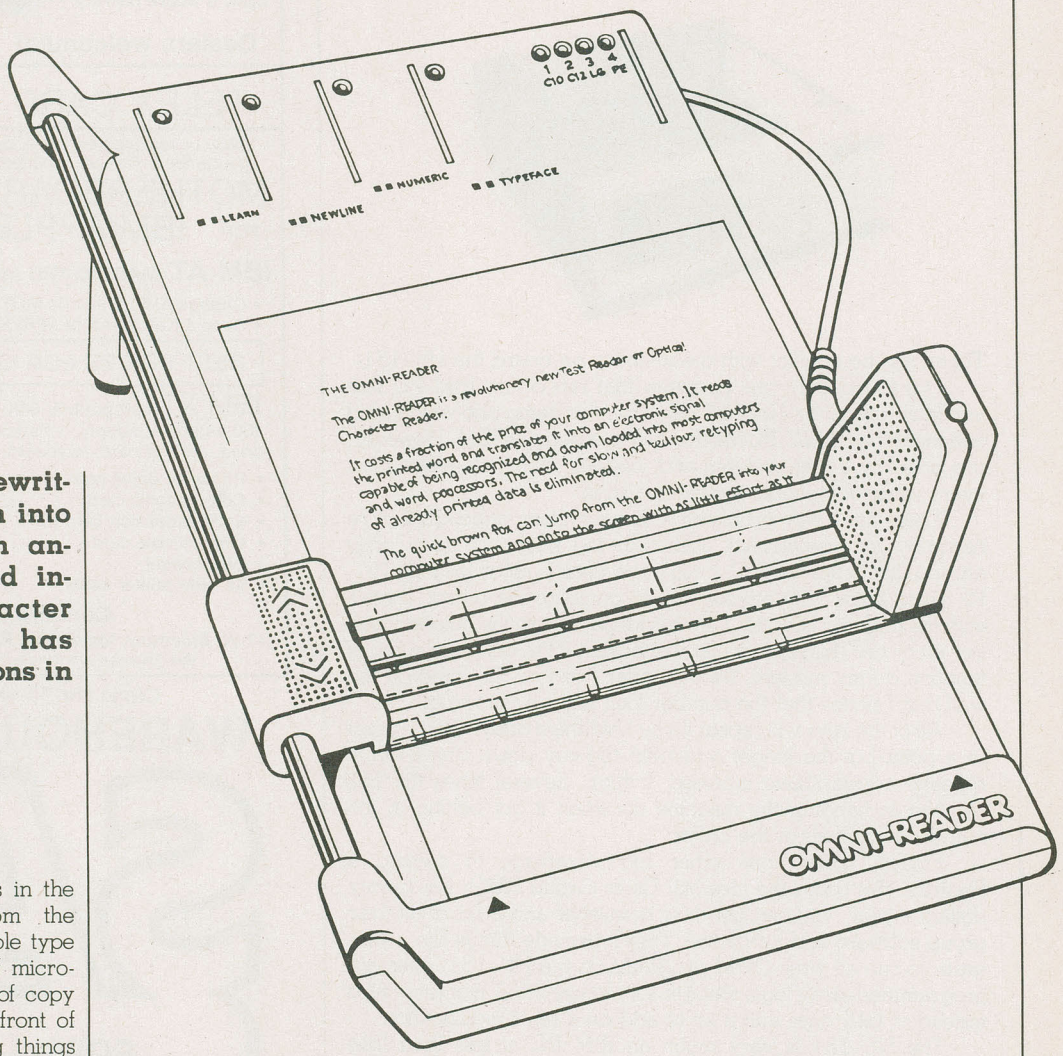
All of the keys will repeat if you hold them down. This is great to a point but the longer you hold the key down, the faster it repeats, a logarithmic increase, I think. Several times this has resulted in hanging the machine up when it got behind in the number of repeats in the buffer.

Finally, there's one other big advantage to owning a Heathkit, this being the Heathkit Users Group HUG. For twenty dollars a year, you can get their newsletter and a list of all their group software and hardware. They'll provide things like a program to run all your CP/M programs on the HS–151, alternate programmed array logic chips to let you use 256K memory chips instead of 64K ones and a kit to add on a reset modification.

The HS–151 is very much an IBM PC at less than IBM prices. If you're not afraid to learn to use a soldering iron and you can follow simple, concise instructions you'll enjoy putting it together and learn a lot at the same time. There are cheaper IBM clones but none of them are as compatible or will do as much or have as much documentation. **CN!**



Omni-Reader Review



This little box takes typewritten pages and turns them into ASCII... it's a sort of an anti-printer. A sophisticated intelligent optical character reader, Omni-Reader has many potential applications in business.

by Steve Rimmer

One of the unbridged gaps in the flow of information from the medieval world of moveable type into the high tech nether space of microcomputers is the dreary existence of copy typists. These diligent ladies sit in front of their word processors transcribing things which really should have been created in machine readable form in the first place.

I mean, it isn't their fault that the Bible was hand written. Perhaps God should have given Moses a box of ten floppies and Kaypro.

Optical character readers promise to eliminate all this, freeing transcriptionists to get on with larger things in their lives, such as writing novels and translating dirty books from Sanscrit. These boxes have been around in various forms for some time. In essence, they take a printed page and spew out ASCII.

Omni–Reader, from Oberon International, is one of the first readily available optical character readers for the IBM PC. In fact, it's really a general purpose system and, while the one I got to play with was intended for use on a blue beast, versions of its driving software are available for many machines.

Too Good to be True

Setting up and operating Omni–Reader on an IBM... or anything more or less compatible... is so foolishly simple as to be trivial. The output of the reader is a standard RS–232C port with its parameters... the baud rate and so on... set by some easily accessible DIP switches. It plugs into the PC's COM1: port.

The software for the PC is a bit more involved. You have to have a CONFIG.SYS file in the system's root directory which adds ANSI.SYS and a supplied program, OMNI.COM, as device drivers. However, with these things in place a lot of really surprising things happen. You can, for example, boot a word processor and have the text from the Omni–Reader spew itself directly into a document.

This is a profoundly well thought out arrangement.

The Omni–Reader itself is a flat plastic thing that looks like it would have been at home in 2010 or one of those other neo–styrene science fiction flicks. Despite its largely petroleum origins Omni–Reader is quite heavy. This, and its rubber feet, keep it from wandering about the desk top while one reads... or omnis, as the case may be.

Unlike some of the more sophisticated optical character readers one comes across at computer shows, the Omni–Reader's motive power is biological. It reads, but you have to move the reader with your own hands. The actual eyes of the thing are contained in a wedge shaped black plastic matchbox that slides along a ruler. The ruler, in turn, slides up and down a steel rod set into the left side of the machine's top.

This is actually the first minor glitch one encounters in Omni–Reader. The plastic works that make all this happen, while by no

means as sleazy as a lot of the injection moulding one comes across in some otherwise very expensive computer hardware, could have been done a lot better. Until you get a feel for using the reader head it tends to bind and move unevenly. As we'll get to in a moment, this is much less of a genuine hassle then it seems... it just makes the machine a bit less comfortable to use.

Having set up Omni-Reader and booted some software to accept its text... I used WordStar for these tests... all one needs do is to slap a sheet with some type on it onto Omni-Reader's sticky reading surface and start scanning. The sticky stuff effectively keeps one's pages immobile. There's a slot in the ruler through which the text is intended to show and, so long as one keeps everything centred, once can simply scan the reader head back and forth along the text, moving downwards at the end of a line, and the words will appear on the screen of one's computer.

There are a number of important things happening here, however. The first one, which is really clever, is that Omni-Reader reads bi-directionally. There is a track of black dots on its ruler which allows it to sense where its reading head is and which way it's going. As such, one can scan to the end of a line and then scan backwards along the next line down. The intelligence within Omni-Reader will sort out the resulting bytes and the text will appear in the right direction in WordStar.

There are, as well, a few hassles in using Omni-Reader. Some of these simply call for getting used to its eccentricities... and some can pose some serious traps for its prospective users, depending upon what one plans to do with it.

In scanning a line of text, Omni-Reader is fairly good at knowing whether it has inhaled good data or garbage. It beeps once for cool words and twice for flotsam and jetsam. However, if one does get the dreaded double beep one must stop scanning and go delete the offending line from wherever it wound up in WordStar.

On a few occasions Omni-Reader managed to generate garbage for me... which wound up as valid WordStar control characters. This got a bit hairy after a while.

Omnivoirs

The first thing that is quite obvious in using the system is that it's important that the ruler slot through which Omni-Reader reads must be fairly accurately positioned with regards to the text that it's supposed to be perusing. In fact, it's fairly intolerant of errors in this respect, and this entails a lot of practice before one gets it right. In the mean time, it can lay down some rather bad text.

Likewise, one must get used to aligning the pages one puts on Omni-Reader's easel very, very precisely, or the thing will garbage the ends of lines.

Secondly, Omni-Reader is extremely discerning as to what typefaces it will read. It likes Courier 10, Courier 12, Letter Gothic 12 and Prestige Elite 12. The numbers refer to the pitch of the typefaces. That's the whole party, and Omni-Reader won't even begin to consider typefaces which don't match these fairly exactly.

You can have Omni-Reader load in an extra typeface. If you have a lot of documents which have been typed on a typewriter with something other than the typefaces which come programmed into Omni-Reader you can have it recognize a new face. However, this turns out to be a pretty laborious procedure. It took about five times as long to make this feature of the system work than it did to get the whole rest of the Omni-Reader package going.

Once one does get the extra typeface function happening, however, the extra faces can be loaded into disk files and downloaded back to the Omni-Reader at a later time through its serial port.

The process of creating an extra typeface for Omni-Reader, however, is such that one pretty well has to have access to the typewriter which created the type to begin with. As such, it's largely impractical to take a document typed in an unknown face and expect to be able to have Omni-Reader sort through it.

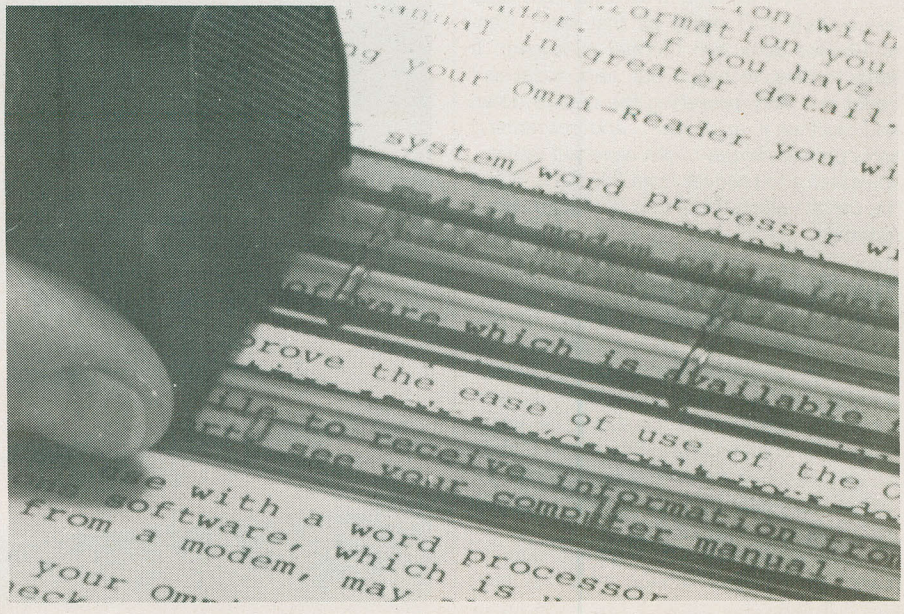
Omni-Reader seems to be fairly adept at dealing with typewriter type... as far as I could tell it absolutely abhors the very thought of proportionately spaced type. I had no luck at all having it scan magazine articles or books.

In dealing with documents it's also important to note that Omni-Reader is very conscious of the quality of the stuff it's looking at. Text typed with slimy worn out ribbons will read very poorly at best, even if one uses the system's poor copy function... which, admittedly, does seem to enhance marginal text a bit. Coloured text also seems to give it something to worry over.

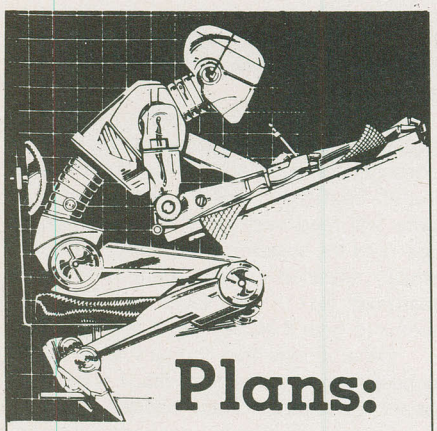
Other things that humans tend not to notice, such as corrections made with liquid paper, can bother Omni-Reader.

One rather peculiar problem with Omni-Reader is that photocopiers tend to reproduce things a tad smaller than their originals in some cases... this can fox Omni-Reader's little silicon brain. It has some flexibility in this respect, but documents which have been through a poorly set up photocopier twice generally stop it in its optical tracks.

Omni-Reader's various parameters and controls are set up by having it scan control text. This consists of two black boxes and a word, like POORCOPY or TYPEFACE. There are quite a few of these things... all the common designations for control characters, for example, are given this way. The five most commonly used ones are stuck to the top of the tablet, and can be scanned by just moving the scanner up to them. Using the rest involves flipping through the manual and scanning it. This isn't really gross, but it is a bit inconvenient. A single large card with all the controls on it



Omni-Reader Review



Plans:

Manufacturer: **Oberon International Limited, 2Hall Road, Maylands Wood Estate, Hemel Hempstead, Herts HP2 7BH, Great Britain.**

Canadian Distributor: **J.B. Marketing of Canada, P.O. Box 422, 241 Pitt Street, Cornwall, Ontario K6H 5T2, 1-613-938-3333.**

Price: **$1,099 alone**
$1,199 with software and cables

Circle No. 60 on Reader Service Card.

would have been an asset.

Unfortunately, due to poor positioning of the reader head, it is possible to mis-scan one of these things, in which case Omni-Reader will beep twice and dump a handful of meaningless characters into WordStar.

The final troll in Omni-Reader is that it has an internal buffer that can get quite full. If you scan a document too quickly... and too quickly isn't really all that fast... Omni-Reader goes into thermal meltdown. It starts to beep its brains out, and, so far as I could tell, only powering the reader down and starting it up again... and rescanning any commands one might have put into it... will allow it to recover from this state. While this doesn't affect the text in WordStar, it is a nuisance.

The Eventual High

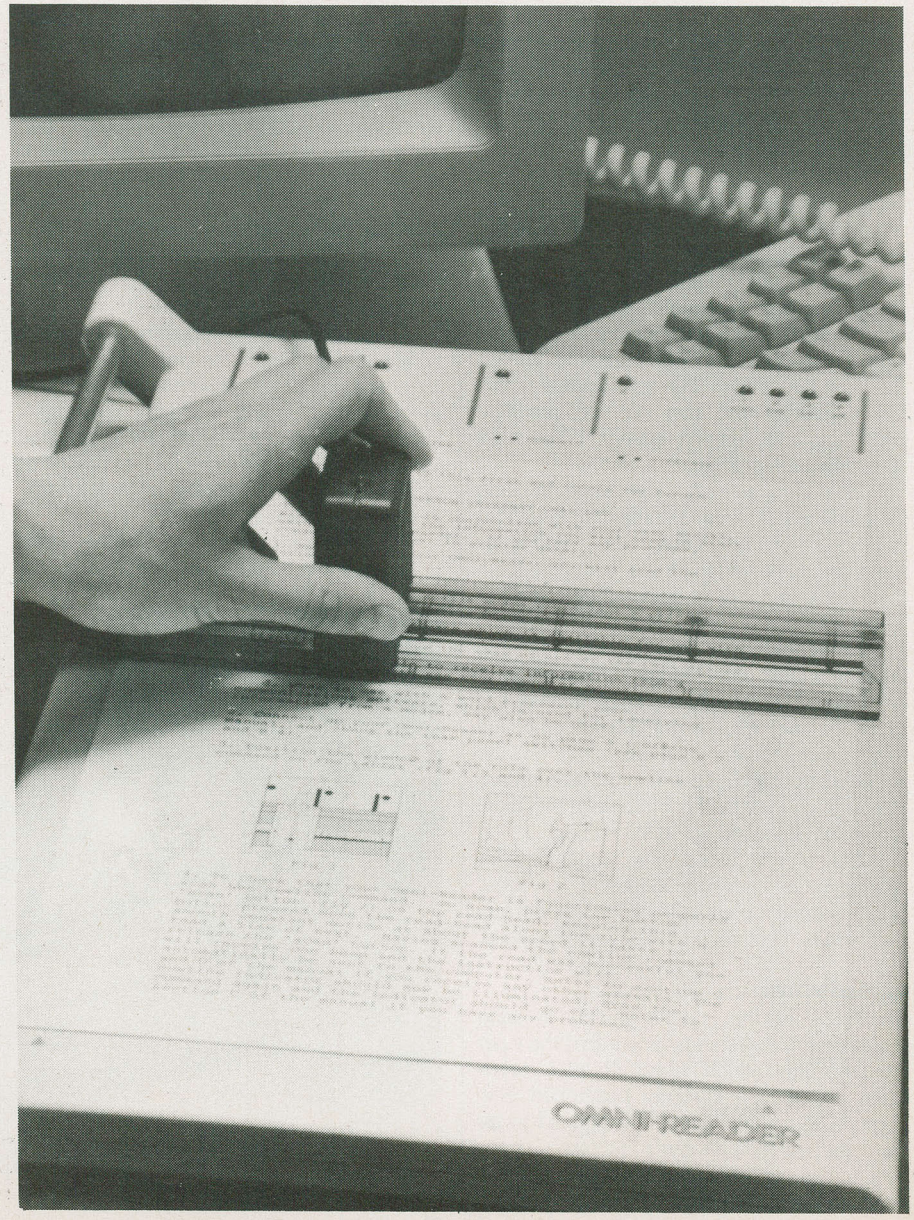
Despite its potential hassles, Omni-Reader doesn't fare badly in use after one has spent a few hours getting used to its personality quirks. Its shortcomings are, however, things which one should be aware of if one is contemplating buying an Omni-Reader. It's a good little box, but not for everything some of its proponents suggest it's suited for.

One could not, for example, plan to have Omni-Reader digitize technical journals. On the other hand, if one were faced with a large stack of typed manuscripts... and one had fairly tight controls over what had been used to type them... Omni-Reader would be a reasonable alternative to a human copy typist.

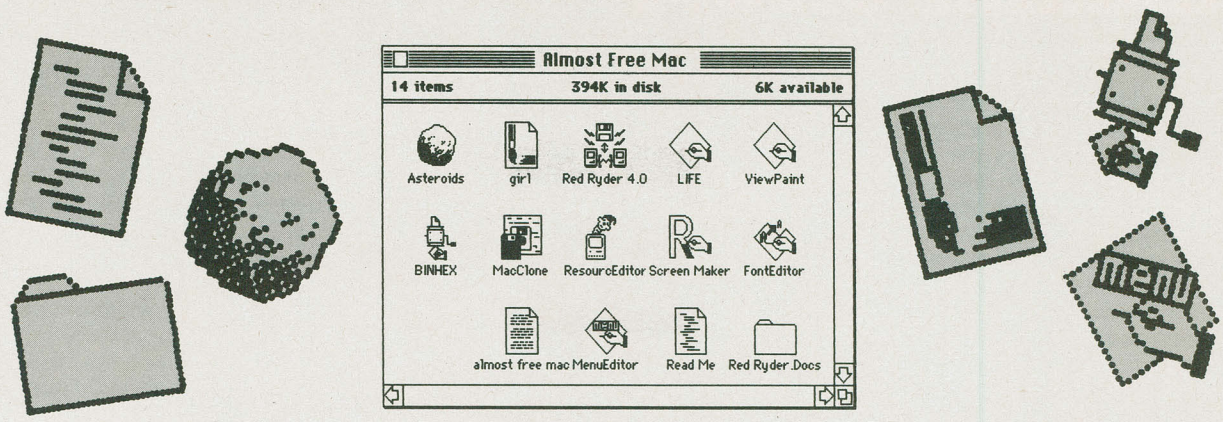
A final question concerning the ultimate practicality of Omni-Reader is its output. While it is electronically capable of handling about a hundred and sixty characters a second... at least, that's what the manual said... in practice the actual stuff one gets through it is considerably less than this. While I'm sure that one would become a whole lot better at using Omni-Reader than I did in the time I had to play with it, I could never get it up much past the output one would expect from a fair to middling typist. Furthermore, on anything but the most pristine originals, Omni-Reader seemed to make about the same number of errors as a real live human would, although its electronic mistakes were a lot easier to spot.

Obviously, whether one has a live typist or an Omni-Reader, one is still going to have to have someone to tend to the machines.

Omni-Reader is an impressive bit of technology and it does what it has been designed to do quite well. In considering it, however, I think that one must give serious thought as to whether its function meets the requirements to which it is to be put. **CN!**



Almost Free Software for the Macintosh



We've had public domain software for the Apple, for CP/M based systems and gallons of it for the IBM PC. After some digging we turned up some equally super stuff for the Macintosh. Some of these programs will blow your socks and some toenails clear off.

This collection consists of almost four hundred K of applications and documentation files. There is something in here for even the most jaded Macintosh user. Feed your mouse now . . . it'll need the energy.

Asteroids This is an implementation of the classic arcade game which is considerably better than most of the ones you lost your life savings in quarters to. The graphics are too splendid to be adequately described with mere words.

Girl Those of us who are quick enough explain this sort of thing as art. The rest call it lechery. However, it's a really well done MacPaint image in any case.

Red Ryder Telecommunications on the Mac has never been this easy. Red Ryder includes the XMODEM and Kermit protocols and lots of other features.

BINHEX A second banana of Red Ryder, this program converts applications files to binary files and back again to allow them to be transferred over phone lines.

Life Life is one of the classic computer programs, and this implementation is exceedingly well done. It simulates micro organisms living and dying . . . and eating each other. Alternately, it might be a parking lot full of Toyotas.

ViewPaint Ever want to check out a MacPaint file in a hurry without getting into MacPaint? This little utility lets you peer at the top bit of a picture with a minimum of overhead and waiting.

MacClone The disk copy routine in the Mac's system disk is a bit barbaric. This is a vast improvement. It even does in some copy protection schemes.

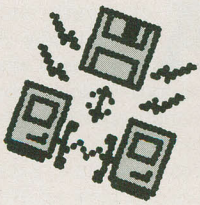
ResourceEditor The icons and other resource items of the Mac just cry out for meddling with. This little tool does it for you.

ScreenMaker Moving text from MacWrite to MacPaint can be a bit disappointing . . . something gets lost in the clip board. This utility lets your words make the trip unscathed.

Font Editor For those longing to make their own fonts . . . and for those who just want to adjust the ones they have . . . this application lets you fat bit to your heart's content.

MenuEditor All those words in the Mac's applications can be changed. This is the way to do it.

All of this rather incredible software plus the disk it resides on can be yours for a mere



$29.95

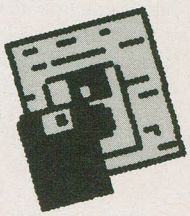
plus 7% sales tax for Ontario residents

Almost Free Mac Software
Moorshead Publications
25 Overlea Boulevard, Suite 601
Toronto, Ontario
M4H 1B1

or save yourself the embarrassment of crying into your mailbox and laugh into the phone

1-416-423-3262

Have your Visa, MasterCard or American Express card ready.



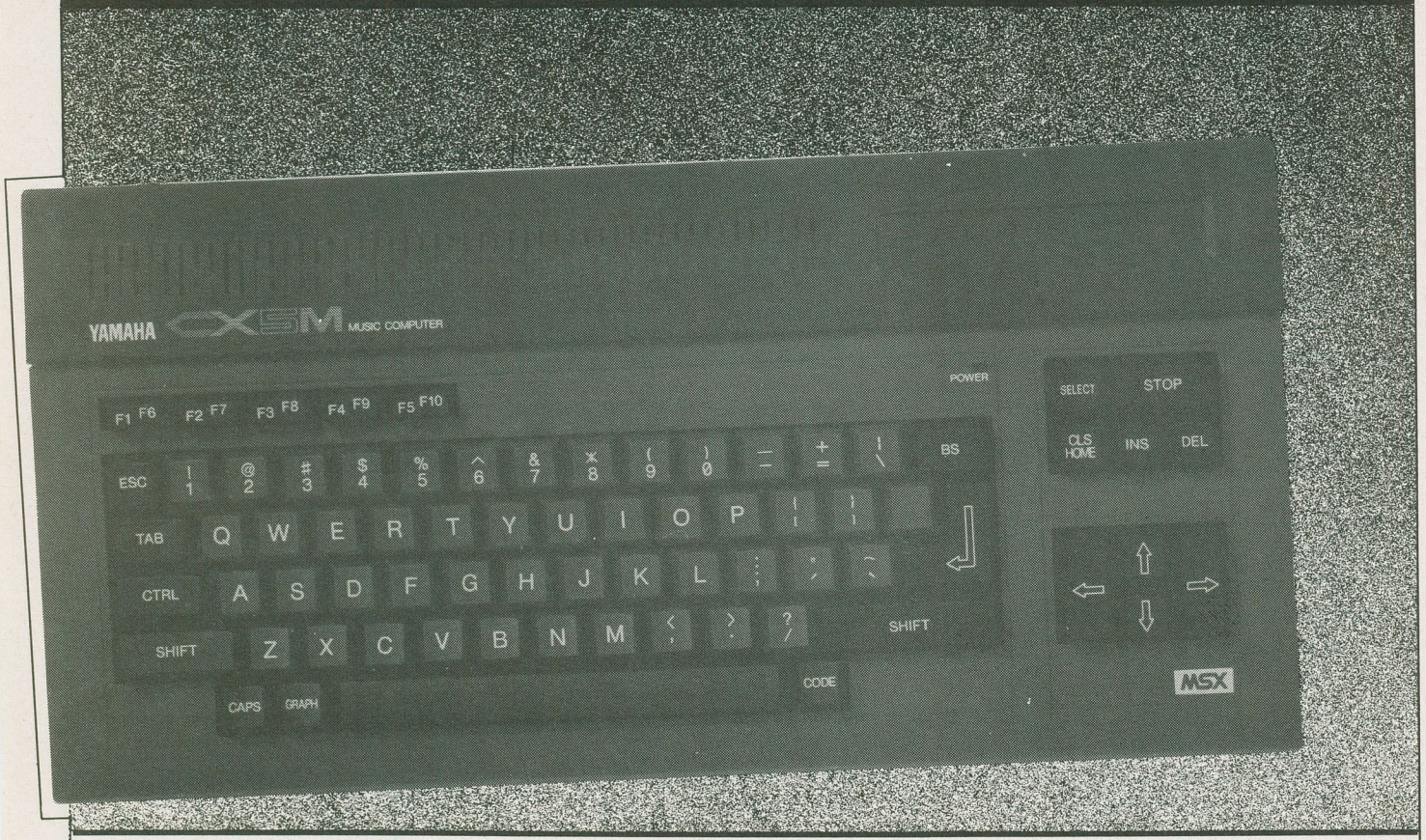
Fine print: All of this software was obtained from public bulletin boards and is believed to be in the public domain. Most of it is freeware . . . the authors would like some money from you. You should probably send them some, but this is between you and your wallet.

We are not charging you for the software, but rather, for our time in collecting, sorting and assembling it, plus the cost of the disk and postage and handling.

We've tested this software pretty thoroughly, and it all seems to work properly. Some of it is capable of hanging the system if it is used incorrectly. Some, like the Resource Editor, will require a degree of knowledge of the insides of the Mac to fully apply it. There isn't much documentation in this area . . . be prepared to have to experiment a bit. We are unable to assist you in applying this software to your specific needs.

This software is supplied without a finder or other system files on the disk. You will have to copy it onto a disk with a system to use it.

Yamaha CX5M



The first of the MSX based small computers, the CX5M's incredible potentials as a MIDI based instrument almost overshadow its functions as a powerful personal computer. Here's a look at the whole party.

by Steve Rimmer

A lot of really nasty things can be said about trashy AM popular music... most heads who regard themselves as serious musicians say them all as a sort of a mantra against commercialism from time to time. There are moments when one really needs to go out in a deserted field for a few hours and blow up Walkmans.

One of the few good things that can be said about the top forty is that, as an industry, it represents a lot of money. As such, large instrument manufacturers have seen fit to pour gallons... or litres, if you must... of capital into developing new toys for it. It's an arguable point that the current generations of MIDI based instruments would never have come to be if there wasn't a large base of potential users for it... no matter how base some of them might happen to be.

The state of the art of MIDI music is unique in that it's almost always about three light years beyond wherever one thinks it is. Even the really slick bits that emerged a couple of months ago are starting to get a bit dated. Newer, still more sophisticated hardware emanates from null space even as you read this.

If you aren't entirely sure about the relationship of MIDI to Western civilization and your place in it you might want to check out the December 1984 edition of Computing Now!, which featured several articles concerning it.

The CX5M computer from Yamaha is another one of those MIDI devices which promises a good quantum and a bit leap for anyone involved in getting sounds together. Far from being simply a computer that plays tunes, it is both a powerful instrument in its own right and a sophisticated and seethingly powerful MIDI controller. The capabilities it brings to the nexus of a host of MIDI based devices is barely describable in anything as archaic as mere words.

Still, listening to a magazine in public will get you a lot of weird looks at best.

Five Pins

Unlike some earlier "music computers", which tended to be very specific, dedicated systems, the CX5M is an actual programmable microcomputer and, what's more, not even a terribly expensive one. Based on the Microsoft MSX standard... there's an article about MSX elsewhere in this edition of Computing Now!... it can be used for all of the things that small personal systems normally do. It'll play games, run a small word processor, handle BASIC programming an so on.

Being an authentic MSX machine it'll do everything that the MSX standard calls for... which is quite a lot. If you check out the MSX article you should have a fairly clear idea of what the CX5M can get happening as a top down computer.

What makes this machine unique is the music system that's plugged into its underside. This extra box provides it with an eight voice FM music synthesizer similar to that of the DX series keyboards and a full MIDI interface to allow it to talk to other MIDI based instruments. It also provides for the addition of an organ type keyboard, the YK-10, to

make the computer into a properly playable instrument in its own right.

As we'll get into, the power of this combination is considerably more impressive than it would initially seem to be.

The first thing that becomes apparent when you start to use the CX5M as an instrument is that the synthesizer that lurks within its fairly low budget case is not the usual noisemaker one finds in computers. We've all checked out the basic control G beep and three voice technomuzik generators that live within Apple's and Commodore 64's. This is very definitely not one of these. In fact, it rivals the capabilities of some of the most sophisticated dedicated keyboard synthesizers available.

Getting purely electronic hardware to produce natural accoustic sounds is actually a lot more difficult than it seems to be because of the extreme complexity of accoustic phenomena. Given something simple, like a couple of notes from a sax or a guitar, the sound not only changes in amplitude over time... its timbre and pitch vary as well. These rather more subtle parameters are largely beyond the scope of simple synthesizers because of the weird ways in which you have to manipulate them to get everything sounding real.

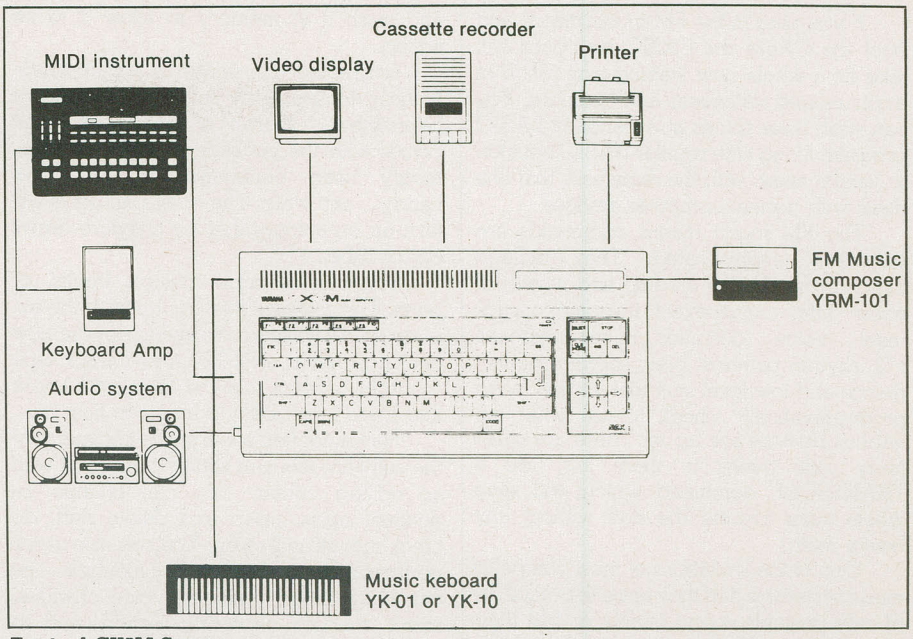
The FM synthesis process that was developed for the DX keyboards... and is also present in the CX5M computer... is a special purpose sound creation system which allows one to create sophisticated, natural sounding voices. The parameters for the voices are stored as digital data, rather than pot settings and patches, and, as such, the system allows for lots of voices to be stashed in memory, edited and called up on command. The CX5M will store forty-six voices at any one time.

There are countless ways of manipulating the parameters of an FM synthesizer, but only a finite number of these have any practical use. These permutations... the lads at Yamaha call them *algorythms*... are hard wired into the firmware of the FM sound generators. As such, one selects an algorythm as the basis of a voice and then fiddles the other sonic components.

In using the DX series of keyboards, editing voices is handled numerically, which is a profound mind fracture at the best of times. The software available for the CX5M allows it to be dealt with graphically. We'll get into all this in a bit more detail shortly.

Finally, in as much as the CX5M is a computer rather than just an instrument, one's edited voice data can be stashed on a cassette or, later on, to a floppy disk.

The CX5M comes loaded with a full stash of built in voices... and extremely good ones... which take quite a while to get bored of.



Typical CX5M System

The second important aspect of the CX5M hardware is its built in MIDI interface. While this is not really necessary if you want to use the system on its own, its facility for letting the machine talk to other MIDI based devices is quite powerful.

The usefulness of the MIDI jacks will be, to a large extent, directly proportional to the magnitude of your Visa limit... and how much extra hardware you want to hang on the system. The system can be a sequencer for another keyboard, a voice editor, a score editor and printer... once again, we'll get into all that in a moment.

Finally, there is a jack in the CX5M which allows one to attach an organ type keyboard to it, the YK-10. As keyboards go this is not exactly a Mason and Riche baby grand, but it's definitely playable. It lacks some of the parameters of the DX keyboards... the tricky aftertouch and velocity things are missing from the YK-10... but it is eminently playable, especially in relation to some of the other plastic keyboards that have appeared for microcomputer music systems over the years. It's certainly on par with things like the Alpha Syntauri for the Apple... and that was a pretty good beast.

All in the Works

The CX5M's hardware is, of course, nothing more than an extremely sophisticated and well thought out black plastic box ideal for smashing cats with unless it has software to drive it. Now, there are those among us who would happily stop at this point and simply find a suitable feline to use with this undocumented option of the system. I can relate to this, but some of those software designers in Tokyo would get quite put off if this review ended on this admittedly esoteric note. Hence, let us now consider the software.

The MSX system has been extremely well designed to support custom applications software. There is, to begin with, a slot in the top of the computer's case which allows one to heave a cartridge into the computer bearing, among other things, additional firmware for the system in ROMs. The MSX software architecture, in turn, has lots of hooks that let such software integrate with the computer's BASIC and operating system.

Being a computer, many users will immediately think of programming the music hardware from BASIC. You don't have to do this to use the stuff and, for many souls this will never be part of the function of the system. However, it's as good a place to start as any, and it gets into the level of sophistication that a lot of the software exhibits.

If one thought about it for a while... and had enough freaky hex numbers to PEEK and POKE... one could very likely control the music synthesizer and the organ keyboard all with standard BASIC stuff. However, it would be unpleasant and, more to the point, unnecessary. One of the ROM packs that one can get for the system is something called the *FM music macro*.

Yamaha CX5M

If you plug in the FM music macro and boot the CX5M the BASIC on board will take on a whole new leaping troll ranch of music related statements and functions. You can stash these things in a standard BASIC program along with regular BASIC notation to handle music with the same ease that one deals with normal computer devices.

The FM music macro commands are extremely sophisticated. They include things to handle the loading and saving of voice data, music event trapping, instrument... voice... definition, music keyboard I/O, rhythm patterns, basic scoring, performance and low level stuff that allows one to programmatically check to see what the various devices are up to. There are some fairly slick things in there too, like a TRANSPOSE command which will sling whole tunes around the staff without any heavy math.

One of the limitations of most computer music systems is that they are either capable of only passable sound quality or that their programming facilities are severely limited. Adding the FM music macro to the CX5M allows one to overcome both of these hassles. One has all the control a real programming language avails one of and an impeccable synthesizer to control with it.

The programming potential of these features teleports the mind from the dim recesses of its cranium and hurls it into a stable orbit. Aside from the obvious programs to play tunes and display the notes you've played on the screen, one can write all sorts of specialized MIDI routines, music and graphics programs, instructional things and so on.

The Canned Software

There are ROM cartridges available for the CX5M which don't require any knowledge of computers at all, and for a large proportion of players it is in these that the box will really shine. These things make the system into a turnkey instrument... you just plug in a cartridge, hit the power switch and it all happens.

The music software in these packages, sophisticated though it turns out to be when you get into it, is extremely well human engineered. Real slavering idiots will be able to comprehend much of it with only a bit of cerebral heating. The rest of the sentient universe will walk right through it.

The more useful of the two boxes I tried extensively on the system was the FM music composer. It's a sort of glorified sequencer, really, although its capabilities far exceed those of what a sequencer is traditionally thought of being able to handle. It will take music played on the system's organ keyboard, draw a score for it in real time and stash it in memory to allow it to be edited.

In practice, the system is extraordinarily easy to use. One sets up a couple of parameters... there's a cheat card that comes with the package to keep the commonly used commands and controls handy... and wails. The notes one plays will turn up on a score that the software draws on the tube.

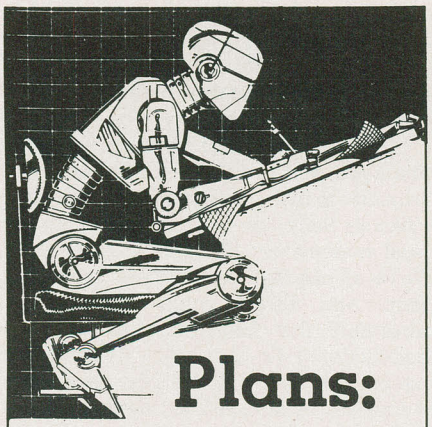
You can overdub multiple tracks, or *parts*. The software lets you listen to the existing tracks while you're laying down a new one. It behaves a lot like a multitrack tape recorder, except that the tape can't break and there's no Dolby to forget to turn on.

Having gotten some music into memory the software lets you scurry through it with an editing cursor. You can change individual notes, insert and delete stuff, do block moves and so on. You can also install performance parameters. For example, one can have tempo changes, voice changes, meter changes, repeating sections and so on happen anywhere in a score.

Completed pieces can be saved to take as music data, to be called back and re-edited later on. You can also print the scores out on an MSX compatible printer. I didn't have an MSX compatible printer so I'm not too sure how well this function works. It should be cool.

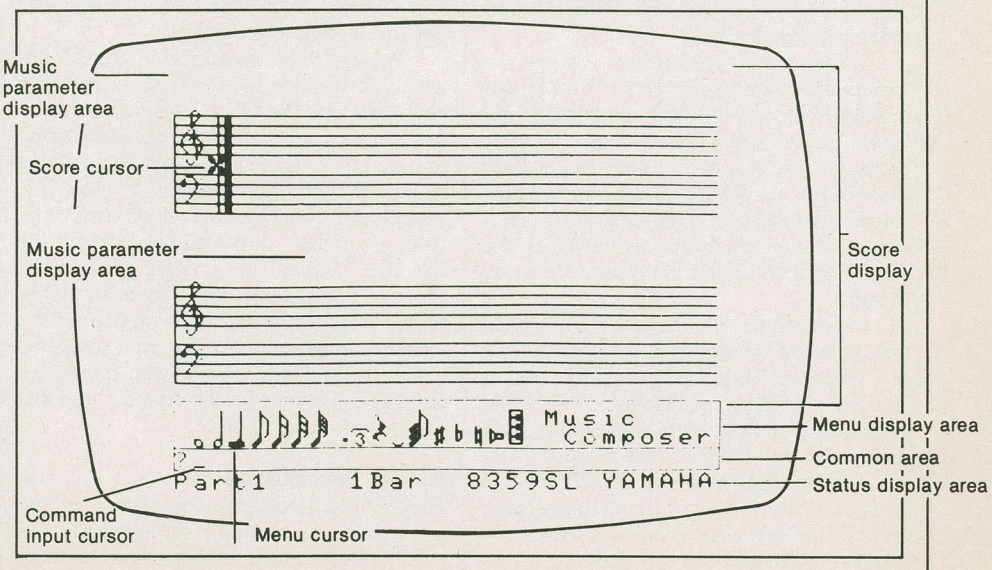
Finally, the FM music composer can talk to other MIDI based instruments or computers through the MIDI interface. While the CX5M has an eight voice synthesizer... the equivalent of eight MIDI keyboards... most MIDI things are single voice polyphonic instruments. As such, the software can send each of the parts of a score to a different MIDI instrument if you have more than one on line.

One can also have the CX5M serve as a sequencer and score editor for another MIDI device, accepting data in over the MIDI bus. This is a good trip, for example, if you like playing a DX-7 better than the YK-10.



Plans:

System:	**Yamaha CX5M**
Processor:	**Z80A**
Operating system:	**MSX**
Manufacturer:	**Yamaha Music**
Distributor:	
Price:	**CX5M - $695.00** **YK-10 - $320.00** **FM music macro - $59.95** **FM music composer - $59.95** **FM voicing program - $59.95** **DX-7 voicing program - $59.95**



CX5M music composer screen display

Table One

The preset voices of the CX5M.

1. Bright brass
2. Sonorous brass
3. Trumpet
4. Sonorous strings
5. Real strings
6. Electronic piano 1
7. Electronic piano 2
8. Electronic piano 3
9. Mild guitar
10. Funky electric bass
11. Mild electric bass
12. Electric organ 1
13. Electric organ 2
14. Majestic pipe organ
15. Small pipe organ
16. Flute
17. Piccolo
18. Oboe
19. Clarinet
20. Glockenspiel
21. Vibraphone
22. Xylophone
23. Koto
24. Zitar
25. Funky clavinet
26. Harpsicord
27. Bell
28. Harp
29. Bell and brass
30. Harmonica
31. Steel drum
32. Timpani
33. Train
34. Ambulance
35. Small bird chirping
36. Raindrops
37. Brass
38. Flute
39. Guitar
40. Horn
41. Funky electric bass
42. Mild electric bass
43. Snare drum
44. Cow bell
45. Percussion 1
46. Percussion 2

Complementing this package there is the FM voicing package, another plug-in box. This is a sophisticated voice editor which allows one to create and modify voice data for the CX5M and save it to a cassette. It can thereafter be sucked in by any other piece of music software, such as the FM composer or a BASIC program.

Creating or changing the parameters of a voice is quite a task. The FM voice software makes it a lot easier by letting you look at things graphically. All the Yamaha synthesizers which have FM synthesis have described the voicing algorythms as collections of little boxes that look like an Anthony Braxton album cover. This software even allows you to see these things visually... a decided asset.

In fact, the operation of this package is extremely simple. Understanding what all the concepts involved in FM synthesis are about is considerably more difficult. There's a pretty lucid section of the manual that gets into this, but be prepared to have to put new Duracells in your brain to get it together at first.

There is also a voicing program available for the CX5M that allows it to serve as a voice editor and store for the DX-7. For anyone owning a DX-7 this will probably make the CX5M worth what it costs for this function alone. The DX-7 has a magnificent synthesizer but a barbaric editing system.

Coda

The music facilities of the CX5M tend to overshadow its facilities as a computer. It's good for less artistic stuff too. It's fairly rugged, pretty well thought out and seems to conform extremely well to the MSX standard, making it suitable for a wide variety of tasks.

While users... or potential users... of MIDI based hardware may not see the immediate need for something like the CX5M in what they're doing, it's one of those things that seems like a natural addition to all the other stuff once you actually get one. It gives one an order of magnitude better control of a MIDI system as a whole, and a visual display makes a lot of what MIDI can do in theory useable in practice.

The system would be considerably more useful with the addition of some floppy disks. The MSX operating system allows for these.... it's unclear whether the canned software will support these, however, as it stands. Methinks special disk drive versions would be called for.

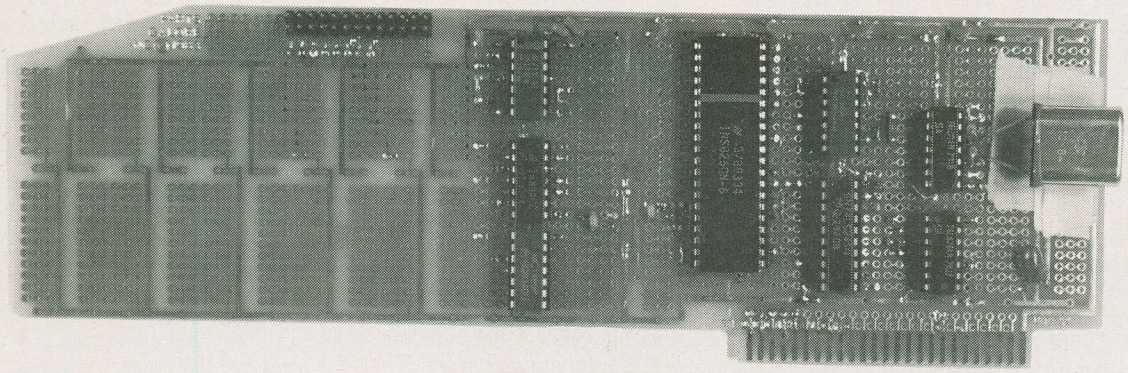
The CX5M is a really tight little computer as computers go, but it's a unique asset to MIDI music. In a real sense it's the missing element in the concept, the one box that makes all the other boxes behave.

We got our review sample of the CX5M from X.L. Electronix, 317 College Street, Toronto, Ontario M5T 1S2, telephone 1-416-921-8941, purveyors of fine computer music systems and gadgets for over 1/400 of a century. They also have all sorts of MIDI synthesizers... including the oft mentioned DX-7... digital drum systems, accessories, styrofoam and other sonic hardware. CN!

The Incredible Cheap Fruit Serial Card

If your Apple compatible system screams at you daily for the blessings of a modem... or if your three hundred baud plug in just isn't quick enough any more... you unquestionably need a serial interface card. This one, based on the popular 8250 chip, can be built for peanuts, albeit several hundred pounds of them.

by Brian Greiner



I like Apples. They play such marvelous games. In fact, I've named my own Apple *PlayThing*. However, once the bloom of games has faded one searches for other uses for one's thousand dollar paperweight. One of the more interesting uses of computers is talking to other computers, usually over a modem.

Of course, the whole concept of modems connected to Apples depends on having a serial interface. Modems can be bought quite readily and are just not cost effective to make from scratch. Serial interfaces, on the other hand, can be quite readily constructed by anyone who can solder a wire without roasting his or her fingers in the process. Consider the one that follows, for example.

The low cost serial interface we'll be looking at in this feature has been very carefully devised to be useful without a great deal of programming. To put this another way, it has been concocted so as to be readily useable with software designed for an existing... although no longer readily obtainable card... the PDA 232C. Much of the software which is comfortable with this card, including MDM730 and Camelterm, to be found elsewhere in this issue, will work splendidly well with this card.

The Fundamentals of the Hardware

The whole interface requires only eight integrated circuits, as can be seen by referring to its circuit diagram. The heart of the circuit is the 8250 chip, which is widely available and fairly cheap at about twenty dollars. This is a very powerful serial controller chip with more features than most people need. It's the same one that's used in the IBM PC's serial ports.

The rest of the chips are simply "glue" to allow the 8250 to talk to the Apple and the outside world.

The 74LS245 chip, U4, is a tri-state buffer that allows the 8250 and the Apple to communicate without interfering with any other peripheral cards. The buffer is controlled by U7, a 74LS00, which turns U4 on only when the serial card is being accessed by the Apple.

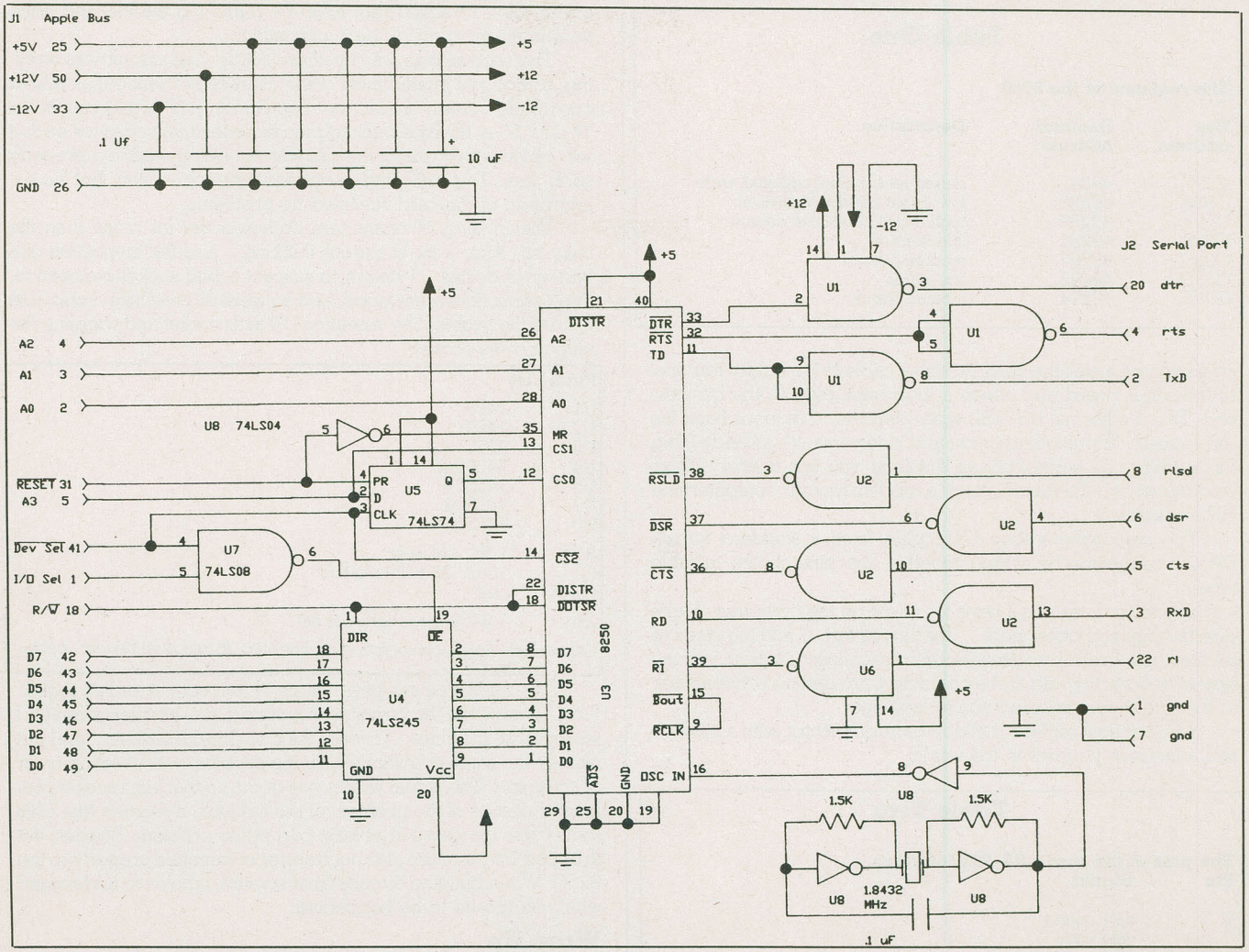
The only tricky bit of the circuit is U5, the 74LS74, a flip flop circuit wired as a divider. The Apple's 6502 processor is rather strange, and when it's requested to do an indexed write operation it performs a read operation before the write. This created something of problem for the 8250 since some of the registers are flagged when their data is new, and these new data status flags are cleared when they're read even once.

What U5 does is disable the 8250 for a single complete read operation so that only the indexed write operation is performed, and any new data is thus not disturbed.

The interface chips U1, U2, and U6 are used to shift the voltages required by the 8250 and the RS-232C standard to the values required. The standard RS-232C signals are positive and negative twelve volts, while the 8250 works with five volt signals.

The 8250 requires a precise crystal controlled clock circuitry, which is supplied by a crystal and a couple gates of U8. Most applications of the 8250 use its own internal crystal oscillator, which saves a chip. However, as this card is designed to be an inexpensive serial interface... and may well find itself being built with fairly wide tolerance parts... the external oscillator serves to provide a more stable clock for the chip. This is especially important at the very high baud rates of which the chip is theoretically capable.

The internal registers of the 8250 appear to the computer as I/O locations, defined by the slot number. The base addresses of the registers are given in table one. To convert the addresses to real addresses, add the slot address. The slot address is defined as



The complete circuit of the serial card. Look ma... no ROM.

the slot number times sixteen.

An explanation of the complexities of the 8250 itself can be found elsewhere in this feature.

The business end of the circuitry is a complete RS-232C connection. All the voltages are the standard bipolar twelve volts. The signals supported are shown in table two.

Construction Details

To build the circuit from scratch requires some sort of prototype card with the proper connector and lots of holes for the components. There are a number of these things available. If you buy an Apple prototype card you'll have a decent board to start with, complete with gold fingers, which is a much better approach than an inexpensive copper flashed card.

To mount the integrated circuits, one can either solder them directly to the board, or use sockets and just solder the sockets to the board. I prefer the latter approach, as it makes swapping components during trouble shooting a lot easier. Be sure to use lots of de-coupling capacitors to absorb the transients generated by the chips, and at least one large electrolytic capacitor for smoothing out the larger transients. Be sure to wire up the output connector properly, as it's very easy to reverse the connections if you aren't careful.

Once the components or sockets are installed, it's probably a good idea to wire up the power connections first. Be sure to use a heavier gauge of wire for this. Having done this, wire up the rest of the circuit, one section at a time. Both wire wrapping and point to point soldering will work fine. I used Beldsol wire in doing the prototype; this is small gauge wire with a thin insulating coating that melts when exposed to liquid solder. It takes some practice to use reliably, but it obviates the need to strip the ends of wires every time you want to connect them to the board.

Once you've wired up the entire circuit, or, better yet, while you're building it, use an ohmmeter to check the connections. This will check both for bad solder connections and wiring errors. I found one bad solder connection this way. Be especially careful to make sure that you haven't shorted out the power leads, or you could fry your computer's power supply.

The Smoke Test

Once you're happy that your circuit is put together properly, put the chips into their sockets and insert the board into your computer. As the instructions always say, make sure that the power is

The Incredible Cheap Fruit

Table One

The registers of the 8250.

Hex address	Decimal address	Description
C087	49287	defeat read before indexed write
C088	49288	low order baud rate divisor
C089	49289	high order baud rate divisor
C08B	49291	line control
C08C	49292	modem control
C08D	49493	line status
C08E	49294	modem status

off when you install the card. Attach a cable to the output terminal of the serial board and attach a loop back plug to the business end. This is a normal RS–232 type connector that loops back the serial card's output into its input, and vice versa. It's a handy thing for testing one's serial port as it will let you see if everything's working without having to attach a modem to your computer and call someone.

You can make a loop back plug from a standard female DB–25 connector by wiring together the pins shown in table three.

Sooner or later you'll have to power up the computer. Make sure that nothing goes "poof"... the smoke test. If nothing starts to smoke, load an appropriate telecommunications program into the system and start typing. If the characters are getting echoed back to the screen uncorrupted you're laughing.

You can now replace the loop back connector with a modem and announce yourself to the world.

Table Two

The pins of the card's RS-232 interface.

Pin	Signal
2	data output
3	data input
4	RTS (request to send)
5	CTS (clear to send)
6	DSR (data set ready)
7	Ground
8	RLSD (received line signal detector)
20	DTR (data terminal ready)
22	RI (ring indicator)

If Things Don't Work

If you've taken reasonable care while building the circuit it should work first time. However, sometimes the gremlins creep in no matter how careful one is. In building the prototype there were two problems. The first, as I mentioned a while ago, was a bad solder joint. I tracked this down by removing the ICs and using an ohmmeter to check each connection.

The second bug was far more subtle. The circuit was working, sort of, but missed most of the characters I sent out as well as corrupting certain characters. Sometimes, a 'P' was received as 'R' and '2' as '0'. By examining the hexadecimal codes for each it was obvious that one of the bits was not being received properly each time. This indicated an intermittent connection, but an examination of the card revealed no problems.

The missing of characters bothered me far more than the flaky bit. After a bit of serious thinking... and the invocation of a variety of deities... I began to suspect a bad socket connection. The connections were good, and so were all the chips. I was able to cure the problem by reseating U4 in its socket and wiggling the chip and the socket.

Table Three

The connections for a loop back connector.

Connect	To
2	3
4	5
5	8
22	20
20	6

Parts List

U1	1488
U2.6	1489
U3	8250
U4	74LS245
U5	74LS74
U7	74LS08
U8	74LS04
R1.2	1.5K, 1/4 watt
C1	10 uf. 35 volt tantalum
C2-9	.1uf
Xtal	1.8432 megahertz crystal

Other stuff: Apple prototype card, sockets, 26 pin dual header, cable.

You might well ask how I came to suspect U4 and its socket. First, I knew that the circuit was working, if a bit intermittently. I swapped all the chips... an easy thing to do with sockets... and got exactly the same problem. Thus, the problem was a wiring error of some sort. The actual wiring was good, so that left a socket problem. Because of the problem of the flaky bit, it seemed that U4's socket was the cause of at least part of the problem. Besides, if it dropped bits, it might also not transfer commands properly to the 8250. When building circuits from scratch, it helps to understand what's supposed to be happening.

Wrap Up

This card is not what one might call a "clone" of a PDA card... it handles a few things differently, and, quite importantly, doesn't have the PDA's proprietary ROM on board. In fact, this on board firmware is useful if you want to do certain things from Applesoft... most notably using the card as a dumb terminal... but, in practice, is very rarely invoked.

Sophisticated telecommunications software is readily available to work with the card. These programs talk directly to the 8250, and, as such, don't miss the ROM at all.

This simple interface is every bit as powerful for most applications as expensive store bought serial ports. It offers things that many commercial cards don't... it will safely run at up to 19.2 kilobaud over hard wires, for example... and it's easy to get together.

The carriers of the planet await you. **CN!**

Notes From the Cat

The problem with having all sorts of flexibility and power is that one is continually forced to use it even if one wants to accomplish something fairly simple. This is true of things other than computers. Consider a typical 1975 blue Chevy pickup truck. It has hundreds of moving parts, an unquenchable gas tank, all sorts of gears... many of them working... complex long polymer molecules in the Glad bag twist locks that hold the rad hose in place, six precision machined pistons with five sets of deadly accurate rings... and one that isn't... the list never ends. It's all capable of traveling over any terrain, in any weather unless it rains and freaks the ignition, carrying immense volumes of stuff and surviving fair to middling apocalypses. However, one is obliged to handle all this awesome power even if all one is up for is getting a Coke and fries from the drive through at Mac's.

Make that a shake and fries. New Coke leaves sugar crusts on your teeth.

The 8250 serial chip that forms the heart of the Apple serial interface card in this feature is something of a 1975 blue Chevy pickup truck, although no one would disagree that the 8250 burns a lot less oil. It can do pots of things that you'll probably never want it to so much as think about. Nonetheless, you will have to placate all of its complex registers and flags if you want to write your own software to use it, even if all you're into is a dumb terminal.

Having written quite a lot of software to handle the 8250, I heartily recommend buying what you need if you possibly can. Beyond this, of course, you can approach the thing with a large stick and intimidate it. The nature of the stick is as follows.

The register map of the 8250 is extremely handy... it's the box around here somewhere with all the bits in it. This allows you to figure out what memory addresses get PEEKed and POKEd to get the 8250 working properly. These registers correspond to the addresses lounging about in table one of this article.

The Incredible Cheap Fruit

	MSBit ← REGISTER BITS → LSBit								
ADDRESS	7	6	5	4	3	2	1	0	
PORT	DATA BIT 7	DATA BIT 6	DATA BIT 5	DATA BIT 4	DATA BIT 3	DATA BIT 2	DATA BIT 1	DATA BIT 0	DDLAB=0 RECEIVER BUFFER REGISTER (READ ONLY)
PORT	DATA BIT 7	DATA BIT 6	DATA BIT 5	DATA BIT 4	DATA BIT 3	DATA BIT 2	DATA BIT 1	DATA BIT 0	DDLAB=0 TRANSMITTER HOLDING REGISTER (WRITE ONLY)
PORT+1	0	0	0	0	ENABLE MODEM STATUS INTERRUPT	ENABLE RECEIVED LINE STATUS	ENABLE TRANSMIT HOLDING REGISTER EMPTY	ENABLE RECEIVED DATA AVAILABLE	IDLAB=0 INTERRUPT ENABLE REGISTER
PORT+2	0	0	0	0	0	INTERRUPT ID BIT(1)	INTERRUPT ID BIT(0)	0 IF INTERRUPT PENDING	INTERRUPT IDENTIFICATION REGISTER
PORT+3	DIVISOR LATCH ACCESS	SET BREAK	STICK PARITY	EVEN PARITY SELECT	PARITY ENABLE	NUMBER OF STOP BITS	WORD LENGTH SELECT BIT 1	WORD LENGTH SELECT BIT 0	LINE CONTROL REGISTER
PORT+4	0	0	0	LOOP	OUT 2	OUT 1	RTS	DTR	MODEM CONTROL REGISTER
PORT+5	0	TRANSMITTER SHIFT REGISTER EMPTY	TRANSMITTER HOLDING REGISTER EMPTY	BREAK INTERRUPT	FRAMING ERROR	PARITY ERROR	OVERRUN ERROR	DATA READY	LINE STATUS REGISTER
PORT+6	RECEIVED LINE SIGNAL DETECT	RING INDICATOR	DATA SET READY	CLEAR TO SEND	DELTA RECEIVE LINE SIGNAL DET.	TRAILING EDGE RINGE INDICATOR	DELTA DATA SET READY	DELTA CLEAR TO SEND	MODEM STATUS REGISTER
PORT	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	DDLAB=1 DIVISOR LATCH LSB
PORT+1	BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	IDLAB=1 DIVISOR LATCH MSB

The register map of the 8250

There are two sorts of data in the 8250, these being bytes, such as are used to move data through the chip or to form the baud rate divisors... we'll get to that... and flags. A flag is a bit, or one eighth of a byte.

The flags in the 8250 tell you things like whether there is a good character waiting to be received, if the telephone is ringing and so on. In turn, you'll have to set the odd flag when you're programming the chip.

Let's start with the simple stuff... well, then, the less grueling part of the ordeal. We are now going to set the baud rate.

The 8250 can be set to any baud rate from nothing up to something near twenty kilobaud. The speed at which it runs is determined by the crystal on the board and the value of a sixteen bit baud rate divisor POKEd into two registers in the chip. The divisor is broken down into two eight bit values.

Unfortunately, the two registers that one puts the baud rate value into are also used for other things. As such, you have to tell the resistors to get set for a dose of numbers by tickling a third register, or, to be more precise, one bit of it. Before you can set the baud rate you have to set the DLAB. Far from being what it sounds like... a chemistry set for dyslexic trolls... the divisor latch access bit is like a little trap door one opens up to shove new numbers into the baud rate divisors.

Here's how one would set the baud rate to three hundred baud, both in 6502 and 8080 for CP/M users.

```
LINCNT      EQU     $C08B+(16*SLOT)
MDATA       EQU     $C088+(16*SLOT)
BAUDLSB     EQU     $C088+(16*SLOT)
BAUDMSB     EQU     $C089+(16*SLOT)
LSTAT       EQU     $C08D+(16*SLOT)

;ADD $2000 TO THESE EQUATES FOR CP/M

;FIRST SET THE DLAB
    LDA     #$80        MVI     A,80H
    STA     LINCNT      STA     LINCNT

;NEXT SET THE BAUD RATE LSB
    LDA     #$80        MVI     A,80H
    STA     BAUDLSB     STA     BAUDLSB

;AND LAST, THE BAUD RATE MSB
    LDA     #$01        MVI     A,01H
    STA     BAUDMSB     STA     BAUDMSB
```

There's a table of baud rate divisor values included here for most of the commonly used baud rates. However, you can, in fact, come up with divisors for any weird little baud rate that slithers into your brain if you have a mind to.

Having set the baud rate, you might want to move some data through the chip. Here's a look at how one would handle a simple dumb terminal, again both in 6502 and 8080.

```
;CHECK FOR CHARACTER TO GO OUT TO MODEM
LOCAL   LDA     $C000       MVI     C,0BH
CMP     #$80    CALL        0005
BMI     REMOTE  CPI         00
AND     #$7F    JZ          REMOTE

;SEND THE CHARACTER TO THE MODEM
STA     MDATA   STA         DATA
STA     $C010

;NOW CHECK FOR CHARACTER COMING IN FROM MODEM
REMOTE  LDA     LSTAT       LDA     LSTAT
AND     #$01    ANI         01H
CMP     #$01    CPI         01H
BNE     LOCAL   JNZ         LOCAL

;AND SHOW IT ON THE SCREEN
JSR     $FDF0   MOV         E,A
                            MVI     C,2
                            CALL    0005

;FINALLY LOOP AGAIN
JMP     LOCAL   JMP         LOCAL
```

The code at the label REMOTE illustrates how one would go about testing for the state of a flag. It looks at the first bit of the data status register, which will be set if the 8250 has received a character and is waiting to have it read out and displayed on the screen. You can test for any flag this way by figuring out what binary value it has.

Under CP/M assemblers you can use the oft ignored binary representation for the values that get AND'd and CMP'd... and then just count places. For example, to see if there is a framing error... we won't get into just why you'd want to do this right here... you would note that the flag for framing errors is the fourth bit along. To see if it is set you could say

```
AND     00001000B
CPI     00001000B
```

You just put a one in the position you want to test for and let the assembler figure it out.

There are a lot of other flags in the 8250. These can be divided into two classifications, to wit, those that are infrequently used and those that are always avoided with a red, foaming passion.

The interrupt handlers are a good example of flags that are never used... well, you probably won't, in any case. The idea inherent in these things is that a complex terminal package can be set up such that the 8250 generates a hardware signal every time, say, a character is ready to be read rather than just passively setting a flag. You can program the chip to create these signals under several conditions.

Table Four

Some common 8250 baud rate divisors.

Baud	LSB	MSB
150	00	03
300	80H	01
600	C0H	00
1200	60H	00
2400	30H	00
4800	18H	00
9600	0CH	00
19200	06H	00

The beauty of an arrangement like this is that the computer can be busy doing other things and only service the serial port if something comes in to be serviced... as opposed to constantly checking to see if the data ready flag is up. We won't look at exactly how this is done because, in fact, it's seethingly difficult to implement in practice and not really necessary for use with a fruit.

Some of the other flags can be quite useful. The ring indicator in the modem status register, for example, is great if you are writing an autodialer. It allows your software to tell if the phone is busy. This is to be preferred over simply waiting for the carrier detect line to go high, as one can realistically expect to wait for up to thirty seconds for a carrier, while a busy signal happens almost immediately.

There is a lot that can be done in programming the 8250... if you want to really get slick you can have it jumping handstands, leaping in the air and generally embarrassing itself in the eyes of its fellow chips. It has enormous potential. You might want to check out the Western Digital specification sheet for this little troll... there's a complete explanation of its myriad capabilities in there.

-Steve Rimmer

MSX: More Small Computers

One of the things that makes the life of a small computer so exciting... and so brutish and short... is the almost total lack of standards for these systems. This new contender for the next generation of personal systems has a lot of power... and everything is interchangeable.

by Steve Rimmer

There will come a day when all the possible combinations of three letters will have been copyrighted by some computer company or other to mean something. It will no longer be fashionable to join two otherwise meaningless words with a capital letter in the middle. All of the Latin prefixes for size... giga, mega, kilo, micro and so on... will have been used to death. Computers will go titleless.

Perhaps we'll have no name computers and generic peripherals.

One of the recent innovations which has contributed its bit to the diminishing availability of three letter names is the MSX standard. You might not have heard of this because it's only just becoming available in North America. However, it's fairly hot in Europe and as slick as a harp seal in a tub of Brylcreem in Japan, where it originated.

The MSX standard specifies some fairly important things for small personal computers. Given that one buys an MSX computer... the manufacturer is irrelevant, at least initially... one is immediately availed of all the software and hardware that's cool for all the other MSX systems available. The fact that there isn't much MSX stuff available at all just now is immaterial... its proponents promise that there will be.

The tottering mounds of decaying microcomputers that would have been standards... bleached bones grinning to the sun...notwithstanding, the MSX stuff looks pretty decent.

Drastic Plastic

The MSX standard is something which was agreed upon a while ago by several Japanese computer manufacturers. In fact, it pulls together a number of diverse elements of microcomputer design. It specifies both the hardware that an MSX computer must be comprised of and the firmware that must be plugged into it, this latter being referred to as the "MSX ROM".

All of this stuff being standard, it is easy to write software which will run on all MSX computers, as well as to design commonly applicable peripherals.

The MSX systems are personal machines... more analogous to Commodore 64s than IBM PCs. However, while they look like expensive toys, they are quite powerful and extremely flexible.

The processor for an MSX based system is the Z80A running at 3.58 megahertz. The video display is handled by either a Texas Instruments 9918A or 9928A video display processor. This, among other things, allows for sprite graphics. A General Instruments AY-2-8910 does three voice sound. There's a thirty- two K Microsoft BASIC on board, at least sixteen K of memory and a dedicated sixteen K video display RAM block.

The MSX standard specifies all sorts of things about how these chips must be mapped to the processor, so that they will behave the same in any MSX computer. Likewise, the Microsoft BASIC ROMs are all the same, and the MSX manuals document them and the other system firmware extremely well. There are, for example, lots of entry points which allow one to use the firmware for machine language programming.

The MSX system supports a fairly flexible arrangement of expansion slots. The basic machine always has at least one bus expansion connector, normally used for game cartridges, applications programs or special additions to BASIC. The BASIC, as

we'll see, is designed to be hooked into to allow one to add specialized commands to it for use in particular situations. The one slot is typically taken up by a slot expander so that several physical slots are available.

As one recovers from the initial gorch of paying for the computer one can buy peripherals for the system, most of which also plug into slots. There are slot expanders to allow for rich people.

The Z80's bus is inherently limited to sixty-four kilobytes of directly accessible memory. However, the MSX standard allows for the paging, or bank switching, of sixteen kilobyte chunks of the address, meaning that sufficiently clever software can access up to a megabyte of RAM. While it is unlikely that one would want this much RAM on such a computer, switching in other pages allows one to hang memory mapped peripherals on the processor's bus without taking up any of its primary sixty-four K space.

In human terms... allowing that not all humans have silicon krispies for breakfast... an MSX computer has a screen which can handle up to sixteen colours. In its text mode, referred to as SCREEN 0 under BASIC, this can take care of a twenty-four lines of forty characters in one colour with no sprites. Moving on up to SCREEN 1 the resolution drops to twenty- four lines of thirty-two characters with limited colour facilities. The next mode, SCREEN 3, allows for 256 by 192 pixels in colour with no text. Finally, SCREEN 4... the overdrive... has 64 by 48 pixel resolution but the colour of every pixel can be selected. Both of the higher graphics modes support sprites.

The BASICs

Perhaps the most powerful aspect of the MSX system is the Microsoft BASIC that comes with it. This is, of course, a severely customized bit of code which supports all of the hardware stuff that it lives in. It has sophisticated event trapping, heavy graphics and sound things and much of the other juice that users of lesser systems have always said that BASIC should have had. Despite the somewhat lower end karma of the MSX machines, their BASIC is in many ways in the same space as the powerful BASICs that come with the IBM PC.

Like the IBM and the Commodore computers, MSX systems support full screen editing for BASIC programs. You would just LIST some code and cursor around to change things. This makes an enormous difference in writing programs... you don't have to type EDIT every time you want to make a trivial change to a line.

The BASIC in ROM for the MSX computers is extremely similar to other Microsoft implementations of BASIC... most of the syntax and a lot of the key words will be familiar to you if you've used anything from a Vic 20 on up. However, unlike as in the case of Commodore's systems, the MSX computers have the most phenomenal support for their prodigious graphics and sound capabilities one could ask for.

There are, for example, CIRCLE, LINE... this draws both lines and boxes... and smaller commands, like PRESET, which plots points. However, there are also VPOKE and VPEEK, specialized versions of PEEK and POKE which locate the video RAM automatically for you and allow you to manipulate it directly. The general versions of these commands also exist, of course.

There is also a very fast PAINT command.

The graphics chip's sprite facilities are also supported. You can create and manipulate up to two hundred and fifty-six sprites without POKEing anything. What's more, you can use event trapping to check up on what the sprites are doing. Therefore, for example, one could write a program which handled lots of sprites and use the ON SPRITE statement to trap their collisions. Having invoked ON SPRITE the program would GOSUB to the appropriate routine whenever two sprites mashed themselves together.

The advanced facilities of the system are extremely impressive. For example, there are lots of bits of the system's BIOS which have been designed to be called from BASIC.

One of the things that makes writing BASIC animation programs difficult, of course, is that BASIC is inherently slow. Sprites by themselves do a lot to get around this, but the ability to trap their activities really gets the whole works into warp drive.

The facilities to create noises... or even music... under MSX are no less impressive than those for images. There are three voices with a variety of waveshapes available, all supported by the PLAY statement and the music macro language which appears in several Microsoft BASICs, including that of the IBM. The music can be set to play in the background, that is, you can execute a PLAY statement which defines a lot of music and then go on to do the next thing the program has in mind while the music plays on.

Music is defined under the music macro language by encoding it into strings. A PLAY string would consist of the notes one wanted played... A through G, plus pitch and duration modifiers like "#" or ".". The octave, speed, volume, waveshape and other overall parameters can also be set within a string, and substrings can be called from within a main string. Notes can also be defined numerically.

There is an equal complement of more mundane... if possibly more fundamental... features in the BASIC, of course. This includes floating point math, all the trig functions, joystick functions, disk and device file handlers, string manipulation and so on.

The Outer Limits

The basic configuration for the MSX machines involves using a... gack... cassette recorder for mass storage. This is, admittedly, extremely slimy and low tech. Fortunately, there are floppy disk drives and a disk operating system, MSX-DOS, available for the whole affair.

Perhaps not surprisingly, considering that it originates with the same folks that do MS-DOS, MSX-DOS makes the system behave very much like an IBM PC at the operating system level. Many of the commands, such as DIR and DEL, work in much the same way. There is also a built in command, BASIC, which pops one back into the on board BASIC.

This is, for a number of reasons, one of the most powerful operating disk systems one encounters on small computers. Rather than simply being an extension of BASIC, it allows for things to be handled as one would on a serious business system. Serious business systems are cool in this respect... they allow one to manipulate one's environment without a lot of bowing and scraping. As with larger computers, the licencing agreement doesn't insist that you wear a tie when you're using the machine, so there are no inherent drawbacks in it.

The disk operating system is reasonably fast... a cat in a slingshot compared to that of some other small systems... which allows for things like proper word processors, small business software which can actually handle meaningful tasks, program development tools of a useful scope and so on. In addition, of course, disk based games and programs can be expected to load within the lifetimes of their owners. The disk operating system is supported by BASIC, so that you

MSX: More Small Computers

can easily manipulate disk files from within your programs.

The advanced facilities of the system are extremely impressive. For example, there are lots of bits of the system's BIOS which have been designed to be called from BASIC. Perhaps the most inspired facility of the BASIC, however, is its expandability. It's quite possible to create new commands for BASIC, heave 'em on a ROM and have them hook themselves into BASIC if the system boots and finds a cartridge in its slot. Thus, for example, if one wanted to customize BASIC to make it fit into a sophisticated music programming language... pretty well what has gone down in the Yamaha CX5M looked at elsewhere in this edition... one could add dedicated music keywords in a ROM cartridge.

In the same way, of course, all sorts of dedicated hardware can be zapped into the system's slots. It's quite reasonable to have a cartridge which contains a set of BASIC enhancements and an interface to be driven by them. Thus, for example, you might have a cartridge that allows the computer to run a video cassette recorder and some commands and functions which relate specifically to that application.

There are suitable MSX compatible printers, modems and other peripheral flotsam available for the system. However, be warned... this is a double edged sword. The system is not happy with most non-MSX peripheral hardware as it leaps out of the styrofoam.

One of the really impressive things that comes with an MSX computer is its manual. Apparently all the MSX systems have the same manual, although most have put their own covers on them. The book is a masterpiece of lucid documentation and attention to detail. It covers both an introduction to programming the system and a lot of detailed low level stuff for when you get deeply entrenched. It's available in a number of languages.

The Wait

One of the things that's scary about proposed or developing standards is that it's always a bit of a crap shoot as to whether anyone is going to get into them. At the moment, the CX5M is one of the few MSX systems that's widely available in Canada. Although it looks like there's to be quite a few others, so much of the promise of MSX is in its generating a massive user base.

If you are looking for a small personal computer, the MSX machines seem to represent a considerable advantage over the more traditional personal systems. Their flexibility is admirable, their power... even allowing for a straight up machine without any of the plug in jewelry... is considerable and the amount of stuff that *should* turn up for them looks to be splendid and diverse. While MSX based computers are excellent with video games and messing about with BASIC, they really get a glow on as dedicated systems, such as MIDI music controllers.

That which actually lands upon these shores remains to be seen. However, potential users of personal systems will want to keep an orb on MSX...

The cartridge racks are approaching even as you read this. **CN!**

Dialog for the PC

The facility of implementing dialog boxes in your assembly language programs is a powerful one indeed... as long as it doesn't drive you mad in the process. Here's some fairly ingenious code to handle them with a minimum of hammering your head against the wall.

by Steve Rimmer

One of the things that I really like about the Apple Macintosh is its ability to handle dialog boxes using nothing more than a few calls into its... admittedly huge... system. If you haven't played with a Mac you'll probably have not experienced these things. However, if it were available on the IBM PC it would be a splendid bit of flotsam.

The basic nature of a dialog box is a window on the screen which displays a message or accepts some input. Unlike the usual fields which one creates on a screen, a dialog box conceptually overlays the screen and, when you're done with it, evaporates leaving the screen as it was before the box appeared.

This is an extremely useful facility in many sorts of programs as it allows you to create prominent messages and convenient input fields without disrupting what's happening on the tube.

Now, under the Mac handling dialog boxes is extremely painless. Its system takes care of heaving the box to the screen and restoring the stuff underneath it when the box goes away. The IBM's screen handler isn't anything like this sophisticated, so having the facility of dialog boxes in your program essentially means having to program the little wombats yourself.

In this feature we are going to look at the code to impliment dialog boxes on the PC in your own programs. The actual program presented here consists of a series of assembly language code modules that can be incorporated into your own stuff.

The Screen's The Thing

Printing a box on the screen of your PC... or any suitably compatible silicon illusion from the mysterious East... is really pretty simple. However, as is the case with all printing, it trashes the text it overprints. This is low tech and, what's more, hardly constitutes a dialog box.

The easiest way to get a dialog box happening is to copy the contents of the screen into a memory buffer somewhere and then restore them to the screen after you are through with the box. This, however, requires that one have a lot of memory hanging around with nothing better to do and it places finite limits on the number of boxes you can nest.

One of the nice things about the ideal dialog box is that having spewed out one dialog box, perhaps with a menu on it, one should be able to spew out a second based on the response to the first, and perhaps a third based on what goes down in the second. In Macintosh terms the box that wants input at the moment is called the "active" window. In the case of this IBM implementation it's the box which has been displayed most recently.

As we'll see, it's quite possible to have infinite box nesting on the PC quite simply with virtually no overhead.

In displaying a dialog box with the intent that what is underneath the box be restored after the box disappears, all we really have to do is to copy the data from that part of the screen where the box is going to go into a buffer somewhere. When the box is to vanish it can be copied back to the screen.

The trick in this system of boxes is mostly in where the screen data goes when the box is up on the tube. Rather than using a special memory area reserved for bits of the screen, this program copies the screen data over the text of the dialog box which is currently becoming active. To look at this another way, it exchanges the screen data with the box data. To remove the box one simply exchanges it again, since the old screen data is now where the box was.

This is an extremely practical system because it doesn't require any extra memory to stash the screen in, even if you have dozens of nested boxes. Furthermore, providing you un-nest the boxes in same sequence as they went up... well, the exact reverse order, actually... each box will restore the one below it. The un-nesting boxes will all return to the places in your program where they started, ready to be displayed again.

It would be handy to be able to use string moves to take care of all this stuff, but, as it happens, this isn't practical for a number of reasons. The primary one is that, in order to be able to write programs which aren't limited to one type of display card one must handle the string through system calls rather than by simply moving data onto it. Furthermore, even if we were prepared to dedicate the code to, say the colour card, the data in the program that holds the box text occurs every byte while the screen data occurs every other byte, the alternate bytes holding the screen attribute data.

What the DIALOG routine does, then, is to start with pointers into the text and a value... in DX... which represents the row and

Dialog for the PC

```
                COMMENT /
        MENUS
        COPYRIGHT (C) 1985
        STEVE RIMMER
                        /
BOXES   PROC    NEAR
        MOV     BX,OFFSET FIRST_BOX
        MOV     DH,ROW1
        MOV     DL,COL1
        CALL    DIALOG                  ;SHOW BOX

GET1:   CALL    GETCH                   ;GET KEYBOARD CHARACTER
        CALL    DECODE                  ;DECODE IT

        CMP     AL,0                    ;IF IT'S A SPACE ABORT
        JNE     NS1
        JMP     NOLOG1

NS1:    CMP     AL,1                    ;IF IT'S F1, GO TO
        JE      LEVEL2                  ;NEXT LEVEL

        CMP     AL,2                    ;IF IT'S F2 ABORT
        JNE     GET1

        JMP     NOLOG1

LEVEL2:
        MOV     BX,OFFSET SECOND_BOX
        MOV     DH,ROW2
        MOV     DL,COL2
        CALL    DIALOG                  ;SHOW BOX

GET2:   CALL    GETCH                   ;GET KEYBOARD CHARACTER
        CALL    DECODE                  ;DECODE IT

        CMP     AL,0                    ;IF IT'S A SPACE ABORT
        JNE     NS2
        JMP     NOLOG2

NS2:    CMP     AL,1                    ;IF IT'S F1, GO TO
        JE      LEVEL3                  ;NEXT LEVEL

        CMP     AL,2                    ;IF IT'S F2 ABORT
        JNE     GET2

        JMP     NOLOG2

LEVEL3:
        MOV     BX,OFFSET THIRD_BOX
        MOV     DH,ROW3
        MOV     DL,COL3
        CALL    DIALOG                  ;SHOW BOX

GET3:   CALL    GETCH                   ;GET KEYBOARD CHARACTER
        CALL    DECODE                  ;DECODE IT

        CMP     AL,0                    ;IF IT'S A SPACE ABORT
        JNE     NS3
        JMP     NOLOG3

NS3:    CMP     AL,1                    ;IF IT'S F1, GOT TO
        JE      LEVEL4                  ;NEXT LEVEL

        CMP     AL,2                    ;IF IT'S F2 ABORT
        JNE     GET3

        JMP     NOLOG3

LEVEL4:
        MOV     BX,OFFSET FOURTH_BOX
        MOV     DH,ROW4
        MOV     DL,COL4
        CALL    DIALOG                  ;SHOW BOX

GET4:   CALL    GETCH                   ;GET KEYBOARD CHARACTER
        CALL    DECODE                  ;DECODE IT

        CMP     AL,0                    ;IF IT'S A SPACE ABORT
        JNE     NS4
        JMP     NOLOG4

NS4:    CMP     AL,1                    ;IF IT'S F1, GO TO
        JE      NOLOG4                  ;LEVEL 4 UNWIND

        JMP     GET4

NOLOG4:
        MOV     BX,OFFSET FOURTH_BOX
        MOV     DH,ROW4
        MOV     DL,COL4
        CALL    DIALOG                  ;UN-SHOW BOX

NOLOG3:
        MOV     BX,OFFSET THIRD_BOX
        MOV     DH,ROW3
        MOV     DL,COL3
        CALL    DIALOG                  ;UN-SHOW BOX

NOLOG2:
        MOV     BX,OFFSET SECOND_BOX
        MOV     DH,ROW2
        MOV     DL,COL2
        CALL    DIALOG                  ;UN-SHOW BOX

NOLOG1:
        MOV     BX,OFFSET FIRST_BOX
        MOV     DH,ROW1
        MOV     DL,COL1
        CALL    DIALOG                  ;SHOW BOX
        RET

BOXES   ENDP

;       END OF MODULE
```

```
        COMMENT         /

        DIALOG BOX MODULE
        COPYRIGHT (C) 1985
        STEVE RIMMER

UPPER LEFT HAND CORNER OF BOX IN DX, POINTER TO BOX IN BX

                        /

DECODE  PROC    NEAR
;DECODES AX FROM GETCH, AL = 0 FOR SPACE,
;1-10 FOR FUNCTION KEYS, FF FOR ILLEGAL
        CMP     AL,0            ;IS AL A NULL
        JNE     DECOD1          ;IF NOT, NOT EXTENDED
        CMP     AH,3BH          ;SEE IF IT'S BELOW F1
        JL      DECOD4          ;IF LESS, ILLEGAL
        SUB     AH,3AH          ;MASK OFF BIAS
        MOV     AL,AH           ;GET RESULT IN AL
        JMP     DECOD5          ;AND SCOOT
DECOD1: CMP     AL,20H          ;IS IT SPACE
        JNE     DECOD4          ;IF NOT, IT'S ILLEGAL
        MOV     AL,0            ;SET TO SPACE
        JMP     DECOD5          ;AND SCOOT
DECOD4: MOV     AL,0FFH
DECOD5: RET
DECODE  ENDP

DIALOG  PROC    NEAR
DLOG1:  CALL    XSTRING         ;PRINT A LINE
        MOV     AL,[BX]
        CMP     AL,0            ;AT END OF DIALOG?
        JE      DLOG2           ;IF SO, SCOOT
        INC     DH              ;OTHERWISE, NEW LINE
        JMP     DLOG1
DLOG2:  RET
DIALOG  ENDP

XSTRING PROC    NEAR
;PRINT STRING IN BX UNTIL NULL, EXCHANGING ITS CONTENTS WITH SCREEN DATA
        PUSH    AX
        PUSH    CX
        PUSH    DX
        PUSH    BX              ;SAVE ALL REGS
        MOV     AH,15
        INT     10H             ;GET THE DISPLAY PAGE
        MOV     AH,2
        INT     10H             ;SET CURSOR TO START OF LINE
        POP     BX
        POP     DX
        PUSH    DX
XSTR1:  CALL    SCRNCHR         ;GET THE CHARACTER FROM THE SCREEN IN AH
        MOV     AL,[BX]         ;GET THE BYTE
        CMP     AL,0            ;IF IT'S A NULL, BEGONE
        JE      XSTR2
        MOV     [BX],AH         ;REPLACE IT WITH SCREEN CHARACTER
        CALL    PUTCH           ;PRINT IT
        INC     BX              ;POINT TO NEXT BYTE
        INC     DL              ;POINT TO NEXT SCREEN POSITION
        JMP     XSTR1           ;LOOP

XSTR2:  INC     BX              ;POINT PAST NULL
        POP     DX
        POP     CX
        POP     AX
        RET                     ;RETURN
XSTRING ENDP

SCRNCHR PROC    NEAR
;GET SCREEN CHARACTER IN AH
```

continued

```
                PUSH    BX
                PUSH    CX
                PUSH    DX
                MOV     AH,15           ;GET THE DISPLAY PAGE
                INT     10H
                MOV     AH,8            ;GET THE CHARACTER
                INT     10H
                XCHG    AH,AL           ;IN AH
                POP     DX
                POP     CX
                POP     BX
                RET
        SCRNCHR ENDP

        ;       END OF MODULE
```

```
        COMMENT /

        DIALOG BOX DEMONSTRATION
        COPYRIGHT (C) 1985 STEVE RIMMER
        NOT FOR DISTRIBUTION IN ANY MACHINE
        READABLE FOR WITHOUT THE AUTHOR'S
        WRITTEN PERMISSION

        "I feel that each of the individuals involved
        should dialog the problem further, preferably
        by themselves..."

                                -J.L. Suitlikker, V.P. Sales
                                Argasm Corp.
                /


        CODEX   SEGMENT
        ASSUME  CS:CODEX,DS:CODEX,ES:CODEX
        INCLUDE CT-EQU.ASM
        INCLUDE CT-MACRO.ASM

MAIN    PROC    FAR
        ORG     0100H
START:  CALL    CLRSCRN                 ;CLEAR TUBE
        CALL    BOXES                   ;DO DEMO
        CALL    CLRSCRN                 ;CLEAR SCREEN

        MOV     DH,24
        MOV     DL,0
        CALL    GOTOXY                  ;PUT CURSOR ON BOTTOM LINE

        INT     20H                     ;BACK TO DOS
MAIN    ENDP

        INCLUDE CT-TEXT.ASM             ;PROGRAM TEXT
        INCLUDE CT-DLOG.ASM             ;PROGRAM DIALOG BOX HANDLER
        INCLUDE CT-CONSL.ASM            ;LOW LEVEL WORKIES
        INCLUDE CT-MENU.ASM             ;MENU ROUTINES

CODEX   ENDS

        END     START
```

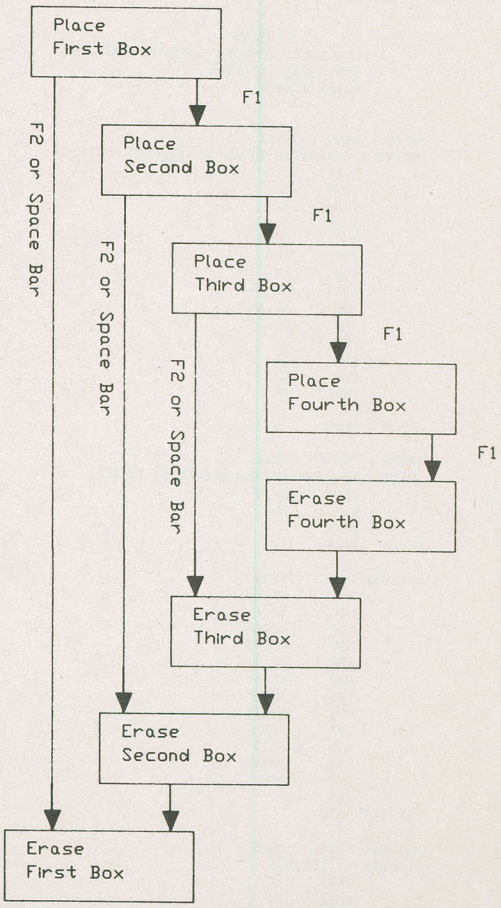
```
                COMMENT         /
        MACROS
        COPYRIGHT (C) 1985
        STEVE RIMMER
                        /

BOX_TOP         MACRO   ARG1
                DB      UL_COR,ARG1 DUP(HOR_BAR),UR_COR,0
                ENDM

BOX_LINE        MACRO   ARG1
                DB      VERT_BAR,ARG1,VERT_BAR,0
                ENDM

BOX_BOTTOM      MACRO   ARG1
                DB      LL_COR,ARG1 DUP(HOR_BAR),LR_COR,0,0
                ENDM


;       END OF MODULE
```




```
                COMMENT /
        GENERAL DEFINES AND EQUATES
        COPYRIGHT (C) 1985
        STEVE RIMMER
                /

LF              EQU     'J'-40H
CR              EQU     'M'-40H

;CHARACTERS TO FORM BOX
UL_COR          EQU     0C9H
UR_COR          EQU     0BBH
LL_COR          EQU     0C8H
LR_COR          EQU     0BCH
HOR_BAR         EQU     0CDH
VERT_BAR        EQU     0BAH

;POSITION OF BOXES
ROW1            EQU     6
COL1            EQU     11

ROW2            EQU     3
COL2            EQU     9

ROW3            EQU     11
COL3            EQU     46

ROW4            EQU     5
COL4            EQU     19

;       END OF MODULE
```

Dialog for the PC

```
                COMMENT /
        LOW LEVEL CONSOLE HANDLING ROUTINES
        COPYRIGHT (C) 1985
        STEVE RIMMER
                /

PUTCH   PROC    NEAR
;PRINT A CHARACTER IN AL AT CURRENT POSITION
        PUSH    DX
        PUSH    CX
        PUSH    BX
        PUSH    AX
        MOV     AH,15
        INT     10H
        POP     AX
        PUSH    AX
        MOV     AH,14
        INT     10H
        POP     AX
        POP     BX
        POP     CX
        POP     DX
        RET
PUTCH   ENDP

GETCH   PROC    NEAR
;WAIT FOR A CHARACTER, RETURN IT IN AL
        MOV     AH,0
        INT     16H
        RET
GETCH   ENDP

CLRSCRN PROC    NEAR
        MOV     CX,0
        MOV     BH,7
        MOV     DH,24
        MOV     DL,79
        MOV     AL,0
        MOV     AH,6
        INT     10H
        MOV     AH,15
        INT     10H
        MOV     AH,2
        SUB     DX,DX
        INT     10H
        RET
CLRSCRN ENDP

GOTOXY  PROC    NEAR
;LOCATE AT (DL,DH)
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AH,15
        INT     10H
        POP     DX
        PUSH    DX
        MOV     AH,2
        INT     10H
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
GOTOXY  ENDP


;       END OF MODULE
```

```
        COMMENT /
TEXT FOR DIALOG BOXES
COPYRIGHT (C) 1985
STEVE RIMMER
        /


FIRST_BOX:
        BOX_TOP         42
        BOX_LINE        ´
        BOX_LINE        ´          Dialog box demonstration
        BOX_LINE        ´      Copyright (c) 1985 Steve Rimmer
        BOX_LINE        ´     This software may not be used for
        BOX_LINE        ´       filthy materialistic purposes
        BOX_LINE        ´       even if you are clever enough
        BOX_LINE        ´             to think of any.
        BOX_LINE        ´
        BOX_LINE        ´                  F1 to start
        BOX_LINE        ´                  F2 to abort
        BOX_LINE        ´
        BOX_BOTTOM      42

SECOND_BOX:
        BOX_TOP         37
        BOX_LINE        ´ - Second Box in the Demonstration -
        BOX_LINE        ´
        BOX_LINE        ´  "...and have you any sheep wax
        BOX_LINE        ´  to sell?" asked Roxanne coyly. She
        BOX_LINE        ´  knew that in all the magical king-
        BOX_LINE        ´  dom of Whipleather there was not
        BOX_LINE        ´  so much as a gram of sheep wax to
        BOX_LINE        ´  be found.
        BOX_LINE        ´       "Yes," replied the old man.
        BOX_LINE        ´  "But I shall not sell it to you
        BOX_LINE        ´  because I do not fancy young
        BOX_LINE        ´  maidens with Mohawk haircuts."
        BOX_LINE        ´
        BOX_LINE        ´         F1 to continue
        BOX_LINE        ´         F2 to abort
        BOX_LINE        ´
        BOX_BOTTOM      37

THIRD_BOX:
        BOX_TOP         26
        BOX_LINE        ´        - Third Box -
        BOX_LINE        ´
        BOX_LINE        ´     "Who you calling a
        BOX_LINE        ´  maiden, bottle nose?"
        BOX_LINE        ´  demanded Roxanne. "Hey,
        BOX_LINE        ´  Fang," she called to
        BOX_LINE        ´  her faithful dog.
        BOX_LINE        ´  "Wanna rip out some..."
        BOX_LINE        ´
        BOX_LINE        ´      F1 to continue
        BOX_LINE        ´      F2 to abort
        BOX_LINE
        BOX_BOTTOM      26

FOURTH_BOX:
        BOX_TOP         32
        BOX_LINE        ´           - Last Box -
        BOX_LINE        ´
        BOX_LINE        ´     Just then the king rode up
        BOX_LINE        ´  on his faithful steed. "Quick,
        BOX_LINE        ´  you must come now." said the
        BOX_LINE        ´  king to Roxanne. "There has
        BOX_LINE        ´  been a terrible accident and
        BOX_LINE        ´  your only brother lies dying."
        BOX_LINE        ´     "Oh good," thought Roxanne
        BOX_LINE        ´  to herself as she mounted
        BOX_LINE        ´  her horse. "A bedroom to
        BOX_LINE        ´  myself at last..."
        BOX_LINE        ´
        BOX_LINE        ´          F1 to finish
        BOX_LINE        ´
        BOX_BOTTOM      32

;       END OF MODULE
```

column of the screen where the first line of the box is to be. We'll regard this as a sort of memory pointer too, although, of course, it has to be translated by the system into a real memory address.

The XSTRING routine starts out pointing to the beginning of a line of text and the leftmost character on the screen where the line is to go. It moves right one character at a time, calling SCRNCHR at each hop. This routine uses a BIOS call to retrieve the character currently on the screen at this location in AH. The XSTRING routine then gets a character from the box text in AL and prints it. The character in AX can then be stashed where the character in AL came from and the routine can move along by one byte.

The end of a line is marked by a null, at which point things are returned to DIALOG, which in turn will point to the start of the next line in the box text and the next line on the screen. If the next line in the box starts with a null it will consider that it has reached the end of the box and scoot.

If It Was Easy...

This program is handled a bit differently than some of the other PC code we've looked at in Computing Now!, in that rather than

being one big file it's actually several little ones. The logical functions of the program are broken down into modules. This, amongst other things, makes it a lot easier to use the parts of the code in your own programs with a minimum of editing. It will also allow us to refer to them in future programs.

About the only tricky bit of the program source code itself is the way the box text is handled. The edges of the boxes are done with the PC's graphics characters... which don't lend themselves to direct representation in a text file, as they all have their high bits set. Furthermore, typing them all in by hand is a pain.

To get around this the program uses three macros, one each for the top, bottom and text lines of the boxes. These put in the edge characters and the nulls that delineate the ends of the lines and of the boxes. The only thing to watch for in this is that the strings which get passed to these macros must not contain any control characters. The biggest hassle in this respect is that large blank spaces must actually be made up of space characters, rather than tabs.

Unfortunately, the Microsoft macro assembler... not exactly a jack rabbit on acid at the best of times... really drops down into first when you start using a lot of macros. As such, I haven't used any others in this program beyond these fairly essential ones.

To get this thing together, enter each of these modules as a separate file. Finally, assemble CT-MAIN, which will suck in the other files as it needs them. The resulting file should be LINKed and EXE2BIN'd into a COM file to run properly. It will display each of the boxes in turn. When you get to the last one it will unpack the screen and return you to a blank screen with the DOS prompt.

You can abort the sequence of boxes either with F2 or with the space bar. In a more complex program it's a good idea to have something like the space bar which will get you out of any complex tree of boxes.

Elephant Talk

This is not a particularly useful program as it stands but the elements of it can be used in decent applications. They are handy from a programming point of view because you don't have to maintain a dialog field at any particular place on the screen. They're also a lot more user friendly than would be a typical dialog field, as someone working with the software in question wouldn't have to keep an eye on a tiny one line area on the tube. You just can't miss a dialog box that comes screaming out at you like half drunk aborigine lettuce breeder unless you're looking at the other side of the room.

If there were more space the story of Roxanne and the sheep wax, of course, could have continued for quite a few more boxes. Roxanne could have ridden off to the field of honour where her brother lay bleeding, a lance mere inches from his noble heart.

"Roxanne, dear sister," her brother would say, gasping dramatically. "I know that I have but a scant time to live. Pray, tell me that you have found a source of magic sheep wax that our mother might be awakened from the trance she was put under by the evil wizard."

Roxanne would ponder this momentarily. "Oh, yes, my brother," she would say. "They have a whole box of it down at Woolco."

Her brother would smile. "Blessed be the heavens above." he would whisper. "I can now go on to the next world with joy in my heart."

"I'd love to help..." would say Roxanne at last, trying not to get any blood on her leather jacket. "... but I can't find your F2 key in all this mess. Lemme call a technician..." **CN!**

Almost Free PC Software

Almost Free Software Volume 1

PC-WRITE While not quite Wordstar for nothing, this package comes extremely close to equalling the power of commercial word processors costing five or six bills. It has full screen editing, cursor movement with the cursor mover keypad, help screens and all the features of the expensive trolls.

SOLFE This is a small BASIC program that plays baroque music. While it has little practical use, it's just a kick to toodle with. It's also a fabulous tutorial on how to use BASICA's sound statements.

PC-TALK Telecommunications packages for the IBM PC are typically intricate, powerful and huge. This one is no exception. It has menus for everything and allows full control of all its parameters, even the really silly ones. It does file transfers in both ASCII dump and MODEM7/XMODEM protocols and comes with... get this... 119424 bytes of documentation.

SD This sorted directory program produces displays which are a lot more readable than those spewed out by typing DIR. It's essential to the continued maintenance of civilization as we know it.

FORTH This is a small FORTH in Microsoft BASIC. It's good if you want to get used to the ideas and concepts of FORTH... you can build on the primitives integral with the language.

LIFE This is an implementation of the classic ecology game written in 8088 assembler. While you may grow tired of watching the cells chewing on each other, in time the source will provide you with a powerful example of how to write code.

MAGDALEN This is another BASIC music program. We couldn't decide which of the two we've included here was the best trip, so we wound up putting them both on the disk. Ah... the joys of double sided drives.

CASHACC This is a fairly sophisticated cash acquisition and limited accounting package written in BASIC. It isn't exactly BPI, but it's a lot less expensive and suitable for use in most small business applications.

DATAFILE This is a simple data base manager written in... yes, trusty Microsoft BASIC.

UNWS Wordstar has this unusual propensity for setting the high order bits on some of the characters in the files it creates. Looks pretty weird when you try to do something other than Wordstar the file, doesn't it... Here's a utility to strip the bits and "unWordstar" the text. The assembler source for this one is provided.

HOST2 This is a package including the BASIC source and a DOC file to allow users with SmartModems to access their PC's remotely. It's a hacker's delight.

Almost Free Software Volume 2

Sweep is a turbocharged Ferrarri of a disk utility which makes the COPY command look like a goat herd by comparison. It allows one to do mass copying, deletion, renaming and other disk functions all in menu driven comfort. It supports essentially the same command structure and behavior as the CP/M Sweep and Disk programs.

Worldmap is a sophisticated graphics program which draws a very detailed picture of the planet we live on and daily endeavour to blow up. It will display its wares on the tube or send them out to a printer.

Anitra plays Anitra's Dance by Edvard Grieg. PC music programs are a gas . . . everyone should have a disk full of them.

Ramdisk is among the most useful of all the utilities you'll ever plug into your PC. It creates a virtual drive on your system out of memory. You can pop your files over to it when you boot the beast and thereafter experience disk accesses that take less time to complete than real drives take to turn on their LEDs.

Alien plays a bizarre adventure game. It leads you into some pretty warped places. It comes with a massive data file for an adventure that you won't get tired of 'til the dragons come home for the evening.

FOS is a personal financial manager which will, among other things, make your cheque books into servants of humanity as opposed to denizens of the aforementioned adventure game. It's thunderously slick.

Jukebox represents yet another PC music system. This one comes with a host of songs to play and some really electric graphics.

Asmgen is one of the best text disassemblers we've come across. It takes any executable COM or EXE file and produces an assembler listing. It's surprisingly good at distinguishing between code and imbedded data or text. If you have need to patch or modify code this thing will outdo DEBUG by light years.

Struct will appeal to the rabid programmer in everyone. It allows MASM to be used to assemble a sort of higher level language. Included also is a test file to illustrate the syntax.

Prtsc replaces the internal PC screen dump code with something more suited to reality. It allows one to hit the PrtSc* key and then select what the screen dump will look like from a menu. It supports a number of popular printers.

Breakout plays a PC version of the popular game. It will accept input from either a joystick or the keyboard. The graphics are good and the action is adjustable from a beginner's level right up to fast and nasty.

Util is a collection of system utilities all under one menu driven roof. Among its many talents are a sorted directory, keyboard redefinition and the facility for scrolling up and down through a text file.

Almost Free Software Volume 3

FIXWS. WordStar, the etherial Martian of word processors, has a propensity of leaving odd bits set in its files. This makes them look remarkably like high tech confetti if you type them or otherwise try to stick 'em in other applications. This program effectively turns them back into ASCII.

WRT. DOS 2.0 allows for each file to have a read only flag . . . although it lacks a way of manipulating them. This pair of utilities allows you to set and unset this flag, protecting important files from accidental erasure.

BROWSE. If you type a text file chances are that the part you want to see will scroll past you before you have a chance to see it, and you'll have to type it several times as a result. BROWSE allows you to scroll in both directions, much as you might if you were using a word processor.

CAT. If the DIR display is too dull for your tastes you obviously need CAT, which will tell you everything you could possibly want to know about the files on your disks.

CGCLOCK This is a simple little program which displays the running time in the upper right hand corner of your screen. However, it has lots of display options and works with the colour graphics card.

CURSOR. This program makes the cursor big. It's pointless, but it's only twenty four bytes long.

CMP. This program does a very elaborate comparison of two files and reports their differences. It can for example, spot corrupted files, and has a multitude of uses when dealing with files created by redirection.

JUMPJOE. A bit like Miner 2049'er, this game is certain to damage your mind. You get to be the janitor of a space station. Deal with berserk robots and other weirdnesses. It's a hoot.

CASTLE. This is unquestionably the best public domain we've ever come across . . . when we got it productive work stopped here for about two days. Wander around a deserted castle collecting treasures . . . but mind you don't get killed by the nasties. A solution is included should frustration set in.

78INT. This is a small BASIC program to calculate interest using the rule of seventy eight.

MOON. One of the nicest lunar lander games we've come across, this little beast uses high resolution colour graphics and decent sound effects to hurl you to your doom in style.

PERCHT. This is another serious BASIC program, this time to print Pert charts.

DATNOIDS. As games go, this one is highly strange. In fact, mere words don't serve to describe it . . . you'll have to try it for yourself.

NUKE-NY. This is one of the nastiest bits of software we've ever seen. It produces a full colour high resolution simulation of a nuclear attack on New York city. It's just the thing to give to paranoid people you don't like very much.

NUDE. Yes, it's a bit exploitive and probably in questionable taste, but it's just so well done. This program uses high resoltuion graphics to draw this chick with great . . . huge . . . pixels.

$19.95 Each

Almost Free PC Software
Moorshead Publications
25 Overlea Boulevard, Suite 601
Toronto, Ontario M4H 1B1

If you just can't wait for the mail . . . nobody lives forever . . . we'll be happy to take your order by phone at 1-416-423-3262 during business hours. Have your Mastercard, VISA or American Express card ready.

Fine Print: all of the software on the Almost Free PC Software disk volume three has been obtained from public access bulletin boards, and is believed to be in the public domain. Some of it is "freeware", and contains requests for contributions to its authors. This is between you and your conscience . . . hit RETURN and they usually go away.

The cost of this package defers our coast in collecting, patching and handling this software, plus the cost of the disk and postage.

We have worked extremely hard to ensure that the programs on these disks will work properly on all PC compatibles. However, it's possible that your system may not be entirely compatible with those of the authors of these programs.

Moorshead Publications warrants that this software will be readable when you get it. If it is not, we will replace your disk. While we have made every effort to ensure that these programs will run properly, we are unable to assist you in adapting them for your applications.

Almost Free PC Software

You can get bored of Lotus 1-2-3 after a while . . . some of us can do it almost before it boots. You can also get bored of WordStar, SuperCalc and AutoCAD. BASIC has enormous possibilities for boredom, while dBase III has been described as being one of the most potentially boring bits of software since the first release of CompuStiff's famous Grave Digger's Database. We won't even get into accounting packages.

Commercial software can be stupendously, tediously, mind numbingly boring unless you have little utilities, patches, fixes and other synthetic trolls to keep your computer partying. This is, of course, why there is Almost Free Software.

In this, the fourth volume of Almost Free Software for the PC, we have rounded up a large collection of patches, games, utilities and business programs than ever before. This single disk contains no fewer than twenty eight unique programs . . . and, of course, no more than twenty eight unique programs. It's the nature of numbers to be dogmatic.

BACKSCROLL Possibly one of the cleverest DOS utilities, Backscroll hooks itself into the PC and buffers whatever scrolls by. Using a very well thought out command structure it allows one to scroll back and forth through text which would normally have scrolled off the screen into oblivion.

BIGCAL is a BASIC program which performs calculations on extremely large numbers. It handles data in floating point form, rather than in scientific notation, which allows for many places of accuracy.

BUGS is a weird little ASCII game. Using the cursor pad one zaps a nuclear fly swatter around the screen blowing up this long crawling bug. It's a scream.

CLOCK is a useful tutorial in writing character oriented device drivers for the PC, as well as being an improved replacement clock.SYS file for many real time clocks. The ASM file is included.

CRYPTO is a BASIC program which descrambles cryptograms. It's an interesting study for puzzle freaks.

DEFRAG is a utility that will allow you to "defragment" your disks and make your applications generally run a lot faster. It re-organizes a disk, connecting up the fragments of files created by DOS.

DOSEDIT is one of the most useful DOS utilities available. It enhances the command line editing facility of MS-DOS by creating a command stack. Now, rather than just being able to recall the last command with F3 the cursor arrows allow you to scroll through a whole stack of previous commands, re-executing the ones you need.

DUMP is a program to produce hex dumps of object files. It's both useful in its own right and a good example of how to use the DOS disk service calls. The ASM file is also included.

FREE is a very tiny file that tells you how much free space you have on a disk . . . without watching a whole directory listing scroll by. It's especially handy on hard drives.

KBFIX displays the status of the keyboard lock keys on the screen and makes the keyboard's character buffer longer to avoid losing bytes.

LABEL changes the labels on drive volumes. It's a simple thing, but useful if you use the labels to keep track of your disks.

LIST is an improvement over TYPE. It shows you the contents of a file with paging, and in a much more civilized fashion.

MEMBRAIN is the most sophisticated RAM disk program we've seen yet. It allows for variable sized disks and a number of other parameters.

MONOCLOK is a screen clock displays program to work on PCs with monochrome displays.

MOVE is a program which moves and optionally erases files. However, you can have it query you about wild cards, such that you don't have to move all the files specified by a wild card. It's very useful.

NEWBELL is a tiny germ of code which changes the sound of the PC's control G beep. It's almost useless, but it's very small.

NUSQ is a file unsqueezer. It's a particulary useful for people who download squeezed files from bulletin boards and need a way to get them unsquozen.

PARCHK is trap to keep the system from locking up and saying "parity error" every time one of these little nasties comes down. It gives you the option of finding out what caused the error and recovering from it.

PURGEDUP is a very sophisticated program for killing off obsolete backup files. It's of great use on a hard drive . . . which tends to get filled up with abandoned files quite easily.

PX is a cross reference generator for assembler programs. It helps you keep track of where you put procedures in large files.

QS is a DOS patch which eliminates the wait one normally experiences while the PC checks out its brains prior to booting. It's not compatible with everything, but it's still extremely handy.

SDIR is an improved sorted directory program.

SP is a very clever print spooler. It will allow you to print files into a RAM buffer and have the PC send them to the printer in the background while you move on to other things.

SPACEINVADERS This a bit of variation on the popular arcade game, but it's fast and the graphics are superb. Green blood will ooze from your drives.

SPEED is a very simple program which changes some of the PC's floppy disk parameters and effectively speeds up the disk accesses for some applications.

VDEL is a multiple file deletion program that queries you prior to snuffing each entry. It's a bit like MOVE but it's much smaller.

WHEREIS will locate a file on a disk even if it lurks in a subdirectory. It's primarily useful on hard disk systems.

WIZARDS is an adventure game in the classic style . . . except that it is easily the most sarcastic program in creation. It's profoundly huge . . . you can wander about its darkened corridors for hours.

This disk, with all of the programs listed here plus the appropriate documentation files is available for a mere

$19.95

plus seven percent Ontario sales tax

Almost Free PC
Moorshead Publications
25 Overlea Boulevard
Suite 601
Toronto, Ontario
M4H 1B1

or, if you want to be high tech you can order by phone. Call

1-416-423-3262

during business hours. Have your VISA, Mastercard or American Express card handy.

Fine Print: This software has all been collected from public bulletin boards and is believed to be in the public domain. The fee charged for it is to defer our cost in collecting it, testing it and putting this collection together, and for the cost of the media and its handling.

While we have endeavoured to make sure that this software does what it says it does, and while it has exhibited no bugs while we were using it, it is possible that some of it may not function properly on some PC compatible systems. We are unable to assist you in modifying this software for your applications.

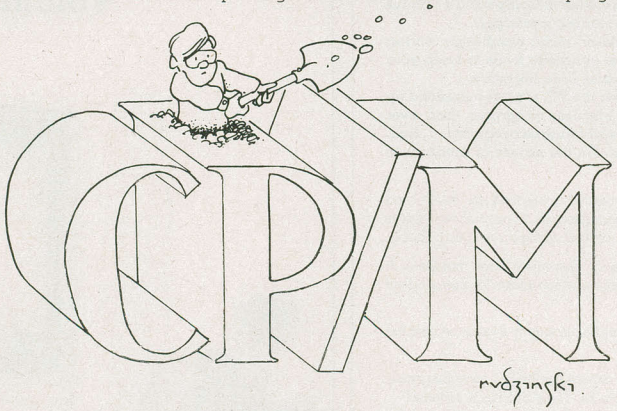
Moorshead publications warrants that the disk you receive will be readable. However, the post office may have other plans. If you are unable to read your disk please return it to us for replacement.

Almost Free CP/M Hacker Software

CP/M is anything but a dead language . . . if you are into hacking code on this powerful operating system you'll know that it's one of the most flexible environments there is to develop software in. Beyond all this, of course, it's enormous fun.

We haven't lost touch with CP/M. Because there is still so much interest in developing assembly language programs for it we have brought together a collection of the latest releases of CP/M based programmer's tools from the public domain. Included here are debuggers, disk utilities and a number of other extremely powerful programs which have evolved into packages which far excel commercial programs in many cases.

Included on this disk are:



SUPERZAP This is a disk utility similar to the DU programs . . . the latest one of these is also included. Superzap lets to modify your disks at the track and sector level, patching code and fixing BDOS errors. However, unlike DU it's all menu driven, with a full screen editor.

DU-V88 The DU programs have been the universally accepted disk utilities for CP/M since prehistoric times. While not overly friendly they offer every conceivable feature. Included here too is the long sought DU DOC file.

MEMDSK32 is the best memory disk program we've ever seen for CP/M. Far from needing a week of hacking to get it going, it runs on any 64K system without patches or parameters to create a 32K RAM disk labeled drive D. The source is included should you want to alter its parameters. This makes things like ASM and MAC work like they had wings on their feet.

ZDEBUG is a Z80 debugger. Its function is analogous to that of DDT, but it works in Zilog mnemonics rather than those of the Intel 8080. As such, it'll handle Z80 code and not give you lines of question marks when you're trying to patch your BIOS or other commercial software.

COPY is a handy program for users of systems that don't have a way to copy entire disks. This will take everything . . . files and system tracks . . . and pop'em over to another floppy. The source file is provided.

PROBE digs through your version of CP/M and tells you everything there is to know about it, including things like the locations of its various components, where things jump to, how the disk allocation is set up and so forth. It's a splendid asset to low level programming.

ZESOURCE and REZ are the most fiendish disassemblers in creation. They will allow you to create pretty good assembler code from a COM file . . . with a bit of ingenuity you'll be able to recreate most existing software to enable you to learn its secrets and patch it for your own applications. It's especially useful for patching CP/M. Both are supplied to allow you to use either simple assemblers or M80 and L80.

ASM65 is a 6502 cross assembler. It runs under CP/M but it assembles 6502 source code. It's extremely useful for developing sophisticated Apple software, of course, and for doing EPROMs for 6502 based systems. In fact, it supports the entire range of 6500 series processors.

MLOAD24 is a replacement for the LOAD command . . . with considerably more power behind it. It is ideal for doing loads that call for merging in overlays, multiple hex files and so on.

All of the above software is supplied with appropriate documentation in the form of DOC files. It is the software we use to create and modify CP/M programs. All of it is in the public domain.

This collection is available for

$22.95

plus 7% Ontario provincial sales tax

(this is two single sided disks or one double sided disk, as needed. It is available for Apple CP/M, eight inch SSSD format and all of the five and a quarter inch formats listed in the Almost Free software section elsewhere in this magazine.)

Moorshead Software Service
25 Overlea Boulevard, Suite 601
Toronto, Ontario
M4H 1B1

or achieve instant gratification over the phone. Call

1 (416) 423-3262

during business hours. Have your VISA, Mastercard or American Express card ready.

Fine Print: All of this software was obtained from public bulletin boards and is believed to be in the public domain. Our charge defers the cost of collecting, testing and assembling this collection, plus the cost of the media and its shipping and handling. We are not charging for the software itself.

We have done our best to ascertain that this software does what it says it does. We are not, however, able to assist you in adapting it for your application.

The Most Valuable Computer Product In Existence

We Offer You Answers

It has been said that computers are the most flexible tools human beings have ever created. This flexibility, however, comes with its price. They are also the most complex.

You are probably an expert in your own field of endeavour but, unless that field happens to be microcomputer applications, you will quite possibly find that you'll be unable to apply computer technology to its fullest potential.

Computers bring with them incredible power . . . and a whole universe of perplexing difficulties.

In creating Computing Now!, Software Now!, Computers in Education, Electronics Today and numerous special publications we have had to become experts in applying microcomputers. We write about them and we use them in the creation of our magazines.

For the first time we are offering our expertise and experience on a consulting basis. We will sit down with you and find solutions to your problems on a one to one basis. We will do it impartially . . . we are not connected with any software or hardware manufacturers and, most important we will advise you based on the latest developments in the industry. We very often know about things which affect microcomputer decisions long before they are released.

For more information contact

Moorshead Publications
Consultation Services
1-416-423-3262
or write
Halvor W. Moorshead
The Moorshead Group
25 Overlea Boulevard, Suite 601
Toronto, Ontairo M4H 1B1

Product Mart

Where Buyers Find Sellers

SOFTWARE clearance from $6.95 for TRS-80, COCO, VIC-20. TI-99 & Atari Home Computers. Free Listing. Specify which computer. **T.M. COMPUTERS,** 786 Bath Road, Kingston, Ontario K7M 4Y2.

TURBO pascal version 2.0 and sidekick. Authorized Borland Dealer — Specify computer — Each Only $69.95 + — **VECTOR COMPUTER SERVICES,** 32 Falconer Terrace N.E., Calgary, Alberta, T3J 1W4, (403) 280-4185.

APPLE & IBM SOFTWARE RENTAL. Try before you buy and rent software at a fraction of the cost. Games, Business, Utilities. Write for a free catalog and state computer. **BIG BLUE SOFTWARE,** Box 15896, Station 'F' Ottawa, Ont. K2C 3S8.

BRIDGE Game Software. 1 to 4 players $39.95. IBM colour and Monochrome, Apple, ADAM, TI 99/4A, 16K TRS 80-1/3/4/Vic-20. **ALLAN'S MICROCOMPUTING,** Box 313, Azilda, Ontario, P0M 1B0 (705) 983-4341.

Advertising in the Product Mart section allows you to reach thousands of Canadian readers nation wide effectively and economically. Please contact us at (416) 423-3262, for further details on the various sizes and styles available.

WHAT DO YOU DO?

Send us your typewritten or clearly printed words, your permanent address and telephone number and your payment (no cash please). Make your cheque or money order payable to Moorshead Publications. We're at Suite 601, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

WHAT DO WE DO?

We typeset your words (and put the first word and your company name in **BOLD** capital letters). Your advertisement will appear in the first available issue.

Moorshead Publications
ORDER FORM

Subscriptions:

Please complete reverse side of order form to start or renew a subscription.

Back Issues: $4.00 each plus 7% Ontario P.S.T.
Please circle issues desired.

1983	April	May	June	July	August	September
	October	November	December			
1984	January	February	March	April	May	June
	July	August	Sept.	Oct.	Nov.	Dec.
1985	January	February	March	April	May	June
	July					

On the following items please add $1.00 for postage and handling plus 7% Ontario provincial sales tax.

Special Publications:

ITEM	QTY	AMOUNT
Hobby Projects $3.95	.....	$ .....
Electronic Circuit Design $3.95	.....	$ .....
Projects Book No. 2 $3.95	.....	$ .....
Personal Computer Guide $3.95	.....	$ .....
50 Top Projects $4.95	.....	$ .....
Your First Computer $3.95	.....	$ .....
Computers in Small Business $3.95	.....	$ .....

Binders:

Imprinted ☐ Electronics Today; ☐ Computing Now!
☐ Moorshead Publications $9.95 each plus 7% P.S.T.

BOOKSHELF ORDER FORM

Code e.g. BP 12	Title (Short form is OK)	Price
.....	.....	$.....
.....	.....	$.....
.....	.....	$.....
.....	.....	$.....
.....	.....	$.....
.....	.....	$.....

SOFTWARE ORDER FORM

Title	Price
.....	$.....
.....	$.....
.....	$.....
.....	$.....
.....	$.....
.....	$.....

Sub Total $ .....
Tax (Ontario Residents) $ .....
Postage $ .....
Total Enclosed $ .....

Orders from the Bookshelf are tax exempt. Please add $1.00 for postage. Remember to put your name and address on reverse side. See over for mailing details.

Do you currently subscribe to Electronics Today Yes ☐ No ☐ Computing Now! Yes ☐ No ☐ Computers in Education Yes ☐ No ☐ Software Now Yes ☐ No ☐

BE SURE OF YOUR ISSUE EACH MONTH. SUBSCRIBE TODAY.

BOOKS, BACK ISSUES, SPECIAL PUBLICATIONS, BINDERS — SEE OVER

Moorshead Publications

Suite 601, Overlea Blvd., Toronto, Ontario M4H 1B1.

MERCHANDISE ORDER ☐ Please fill out form overleaf

SUBSCRIPTIONS: ☐ NEW SUBSCRIPTION ☐ RENEWAL

Electronics Today

☐ One year (12 issues) **$19.95** ☐ Two years (24 issues) **$34.95.**

Computing Now!

☐ One year (12 issues) **$22.95** ☐ Two years (24 issues) **$37.95**

Computers in Education

☐ One year (10 issues) **$25.00** ☐ Two years (20 issues) **$45.00**

Software Now!

☐ One year (12 issues) **$19.95** ☐ Two years (24 issues) **$34.95**

For U.S. please add $3.00 per year ☐ other countries add $5 per year ☐

NAME _____

ADDRESS _____

TOWN/CITY _____ PROVINCE/STATE _____

CODE _____ DATE _____

POSTAL CODE _____

☐ Cheque enclosed DO NOT send cash

☐ Mastercard Account No. _____

☐ Visa Account No. _____

☐ American Express Account No. _____

Expiry Date _____

Signature _____

58

Computing Now!

Canada's Personal Computing Magazine

$22.95

ONE YEAR... ~~$39.00~~

SAVE UP TO 51%

Each month Computing Now! Canada's most widely read microcomputer magazine, provides you with... news, reviews of the latest microcomputer hardware, and software releases.

There are expert applications features, programming guides, and articles on an amazing variety of computer related topics for home and business applications.

Prevent newsstand sell outs and assure immediate delivery. Subscribe now and save up to 51% using the subscription card in this issue. For Next Issue Service, use your Charge Card and Call (416) 423-3262.

Moorshead Publications

Almost Free Apple DOS Software

While CP/M is a wonderful thing in its own right, the Apple computer can also, and usually does, operate under DOS. For this reason, there's a multitude of programs available for it. Below, we offer a mini-multitude of our own.

The following programs will operate on any Apple][+, //e, //c, or true compatible operating under DOS 3.3. Apple users operating only under ProDOS may have to make alterations to some programs.

Almost Free Apple

Picture Coder: All Apple HiRes pictures take up 36 sectors in their binary form. This program creates a textfile of a program in memory, squeezing out the zero bytes, that can later be EXECd into memory. The textfile often takes up less room on the disk.

DNA Tutorial: Operating under Integer BASIC, this program might appeal to 'clone' owners. In actuality, though, it's an interactive low-res graphics tutorial of DNA in its inherent forms. And you thought your Apple was only good for games...

Toad: Speaking of games, this program is an Applesoft BASIC implementation of 'Frogger' that can be controlled with either a joystick or the keyboard. The user's high scores are saved to disk.

Function Plotter: A fairly extensive Applesoft BASIC program that takes any inputted function and plots it on the HiRes Screen.

Data Disk Formatter: Apple DOS disks need not be bootable to be useful. This binary program formats a disk without setting DOS on the tracks, conserving useful disk space.

BASIC Trace: A program for the advanced Applesoft programmer, this file, when EXECd, displays the hexadecimal locations of each Applesoft line number of a program in memory.

Gemini Utility: A word processor pre-boot for Gemini printer users, this BASIC program initialises the printer's font or pitch before you boot your word processer.

Payments: This BASIC program allows you to keep track of payments and credits to and from up to 100 accounts on a single disk. A sample account is included.

Databox: A small but useful database program in Applesoft BASIC. Sample files are included to get you started.

Nullspace Invaders: A quick BASIC HiRes game testing coordination and judgement as you manipulate a monolith through mysterious gates.

Almost Free Apple DOS Software #2

Amort: A monthly amortization program that calculates monthly payments to an inputted figure, calculates principle, interest on every balance, and prints out the resulting chart.

Voiceprint: An unusual program that uses the HiRes screen to sample sounds inputted through the cassette jacks at the back of your Apple. Sampling rate and other variables can be controlled, and two sounds may be compared side-by-side.

Calc NOW!: Written in BASIC, this spreadsheet program is somewhat slower than VisiCalc, but still offers the power you expect from a spreadsheet. With sample files.

Cavern Crusader: A mix of BASIC and binary programming, winning this HiRes game is difficult, to say the least. For every wave of aliens shot in the cavern, there's always a meaner bunch in the wings.

Newcout: With source file. This binary program replaces the I/O hooks in the Apple with its own so you can operate your Apple through the HiRes screen. Comes with a character set.

Charset Editor: A utility to help you create your own character sets to use with Newcout.

Calendar: A BASIC utility useful for finding a particular day of any inputted month and year, or for printing out any given year.

LCLODR: With source. This binary utility BLOADs any given file into the 16K language card space at $D000. The source is useful in showing how to use DOS commands through assembly language.

Cristo Rey: An animated HiRes BASIC program showing Cristo Rey by moonlight. For apartment-bound romantics.

ATOT: That's an acronym for 'Applesoft to Text'. EXEC this textfile to produce a textfile of your program.

Applesoft Deflator: This program takes a textfile made by ATOT and squeezes it, replacing PRINT statements with '?' and removing unnecessary spaces from the listing.

Almost Free Apple DOS Software #3

General Ledger: A fairly massive BASIC General Ledger program. This program creates a number of files, so it's best put on a separate disk before implemented.

EE-Design: A shape design aid program written in BASIC. Allows the user to plot shapes in HiRes and either save them to disk or print them out.

Quickzap: A disk sector utility that reads a given track and sector into memory and allows you to alter it, and optionally write it back to disk.

Softgraph: A complete graphing program written in both Applesoft and binary that enables you to see your data done up professionally in pie, line or bar charts.

IntelliCalc: An intelligent calculator with three memories and a 'paper tape' readout. Data may be inserted at any point.

Poker!: An Applesoft BASIC implementation of the game that has ruined many a marriage. Fortunately, you can afford to lose your electronic paycheque to you Apple... for now.

Polar Graphics: Similar in some ways to Function Plotter, this Applesoft program supplies a number of attractive functions in REM statements that you may utilize to plot out on the HiRes screen.

Clock and Clock II: Two Applesoft digital clocks. When your Apple's doing nothing better, it can now remind you of the time you're wasting. One has an alarm function.

Flowers: With source. A binary program that prints a border of flowers to the HiRes screen. The source is invaluable in showing how to handle HiRes shapes in assembly language.

Convert Utility: A BASIC program that converts numbers between decimal, hexadecimal, binary and disk sectors.

ProDOSfix.TXT: Apple clone users who've purchased ProDOS will note that it doesn't work on their machines. This text tutorial explains why, and how to remedy the problem.

Fine Print: The majority of this software has been obtained from on-line public access sources, and is therefore believed to be in the public domain. Any remaining programs were written in-house. The prices of the disks defer the cost of collecting the programs, debugging them, reproducing and mailing them, plus the cost of the media they're supplied on. The software itself is offered without charge.

Moorshead Publications warrants that the software is readable, and if there are any defects in the medium, we will replace it free of charge. While considerable effort has been made to ensure that the programs have been thoroughly debugged, we are unable to assist you in adapting them for your own applications.

Each disk is

$19.95

or, as an introductory offer you can order all three for

$39.95

Telephone order credit card payments accepted.

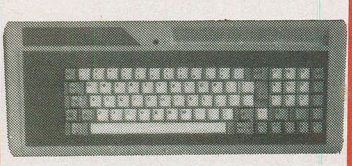
Ontario residents please add 7% Provincial Sales Tax.

Software Services
Moorshead Publications
25 Overlea Boulevard,
Suite 601,
Toronto, Ontario M4H 1B1
(416) 423-3262

COMPUTER PARTS GALORE INC.
316 College St.
Toronto, Ontario M5T 1S3

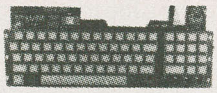
Toll Free Orders Only
1-800-387-1385
Order Checking (416)925-8291
Technical Data (416)925-1105

APPLE IIe®
DETACHED NUMERIC KEYBOARD
$99.00



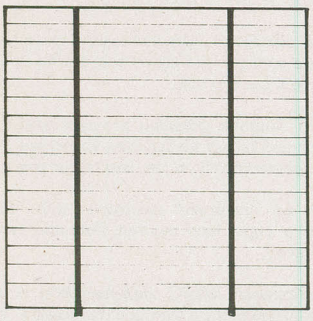
For those of you who would like to put your IIe in another case we have a high quality 100% plug in compatible Matrix keyboard with all IIe keys plus the highly desirable numeric keypad for quick entry of numeric data **$99.00**

ASCII KEYBOARDS



Now, we have a new keyboard, micro controlled with 3 levels of pre-coded functions for Basic, CPM etc. and at the same old price as before.
Function Keyboard, Numeric **$89.95**
Function Keyboard, Standard **$79.95**

SOLID ABS CASE
NUMERIC
$59.95

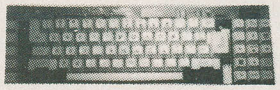


SOLAR CELLS

SOLAR CELLS. These square polycrystalline silicon solar photovoltaic cells have many uses from car top battery chargers, sony walkman power supplies, calculators, radios, nicads, etc. Each cell has an open circuit potential of 0.5 volts that is area independent, and a short circuit current that is area dependent, see list. We have been playing with them here and they are lots of fun, we are going to make up a few large banks of cells as an emergency lighting system. Note can also be used for the ETI solar powered night light. Each order comes with a data sheet and instructions on how best to use the cells.

- High Efficiency
- Polycrystalline
- Antireflective Coating
- Fine Collector Grid
- High Area Factor Square Cells

(a) 1" x 4", 1/2 Amp. **$3.95**
(b) 2" x 2", 1/2 Amp. **$3.95**
(c) 2" x 4", 1 Amp. **$6.95**
(d) 4" x 4", 2 Amp. **$8.95**



This is a high quality Hall Effect keyboard made by Microswitch of Canada for AES data and now bought by us for 10% of the $169.00 that AES paid for them in 10,000 lots. They are a very good word processing keyboard with both serial and parallel data outputs for use with APPLE and IBM type systems and come complete with a ribbon cable connector and complete pin-out. **$24.95**

WIRED CARDS

16K	$ 45.00	Applaext 128K	$140.00
128K no IC	$ 34.95	Sprite gr.	$ 69.95
128K OK	$ 55.00	TMS9918A IC	$ 18.95
128 64K	$ 99.00	DISC SHMRCK	$ 45.00
128K 128K	$150.00	80 Column	$ 65.00
MC3242 IC	$ 12.00	80 Col. Sofsw	$ 69.00
DISC	$ 45.00	Grippler	$ 50.00
Z-80	$ 45.00	Grip cable	$ 19.95
Applacard	$150.00		

NEW LOW BARE PCB PRICES*

- Real time clock
- Rana 4 drive
- 9 V Music
- Disc Controller
- Disc Controller (Shamrock)
- PIA card
- EPROM
- WILD CARD
- SAM TALKS
- COMMUNICATIONS

GROUP 2 **$9.00 each**

- Grippler
- 80 Column
- 80 Column Soft Switch
- Z-80
- RGB
- Sprite graphics
- APPLACARD 128K ADD ON

GROUP 3 **$11.00 each**

• SSM MODEM • APPLACARD • APPARAT EPROM PROG • 16K • 128K

All boards come with a parts list and placement diagram. We have all the parts of the PCB's just ask for them.
***Prices so low we require payment with order**

MEMORY FLASH

256K-150Ns DRAM **$7.95**
64K-150Ns DRAM **$1.00**
64K-200Ns DRAM **$1.25**
Prime stock, limited quantity.

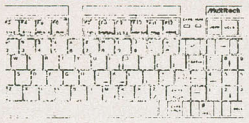
KEYTRONICS
PROGRAMMABLE KEYBOARD
An excellent ASCII Keyboard, fully Apple Compatible. Full size with numeric pad, fully programmable key switches with full data **49.95**

POWER SUPPLY
CSA APPROVED

Our Famous "BLACK BEAUTY" power supply, now reduced in price but not in quality. Our ratings are 5V-5A; 12V-2.5A; 5A-1/2 A; -12V-1/2A for real **$79.95**

OUR 6502 BOARD
Now only $29.95 still with all the versatility of the original and a full 8 slots.

APPLE® DETACHED KEYBOARD $159.00



The excellent MAK-II Apple detached keyboard using serial cata (IBM) format. Plugs directly into Apple PCB

GREAT DEAL

THE GREAT DEAL CARRIES ON FOREVER AND GETS BETTER
Our proven 6502 motherboard plus a numeric case plus a black beauty power-supply plus a numeric function keyboard plus any 4 bare pcb for **$225.00**

CONNECTORS

DB SERIES

DB-25 M solder	$1.95
DB-25 F solder	$1.95
DB-25 M IDC, Flat cable	$5.95
DB-25 F IDC, Flat cable	$5.95
DB-25 M Right angle PCB	$4.95
DB-25 F Right angle PCB	$4.95
DB-25 Shell	$1.00
DB-15 M solder	$1.95
DB-15 F solder	$1.95
DB-15 F IDC, flat cable	$3.95
DB-15 M right angle PCB	$2.95
DB-15 F right angle PCB	$2.95
DB-15 Shell	$1.00
DB-9 M solder	$1.75
DB-9 F solder	$1.75
DB-9 M right angle PCB	$2.50
DB-9 F right angle PCB	$2.50
DB-9 Shell	$0.75

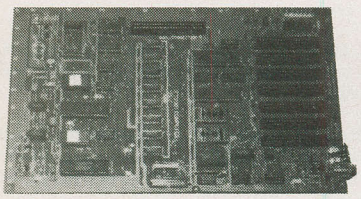
DRIVE CONNECTORS

50 Pin Edge C, 8" drive	$5.95
40 Pin Edge C,	$4.95
34 Pin Edge C, 5-1/4" drive	$5.95
20 Pin Edge C, Hard drive	$4.95
34 Pin Fem header 17 x 2	$3.50
26 Pin Fem header 13 x 2	$3.00
20 Pin Fem header 10 x 2	$2.00

ASSORTED SEMI-CONDUCTORS AND OTHER STUFF

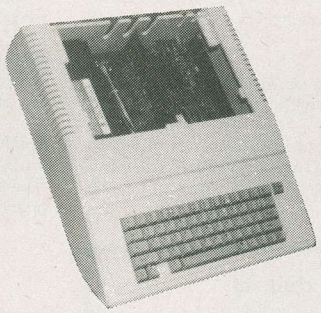
(A) RED LED S/M/L	10/$1.00
(B) GREEN LED S/M/L	8/$1.00
(C) AMBER LED S/M/L	8/$1.00
(D) PIN PHOTODIODES, INFRA-RED	2/$1.00
(E) PHOTO TRANSISTOR, NPN VISIBLE	2/$1.00
(F) LDR (LIGHT DEP RESISTOR)	$1.00

MOTHER BOARD



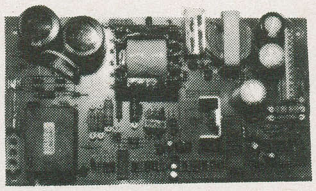
100% IIe® Compatible, for those of you who wish to build a clone of the very popular APPLE IIe®. This board is a reverse engineered copy of the IIe® and is 100% compatible. We have the motherboard and the custom ICs only. All other parts are widely sold. The custom ICs are workalike chips that do not infringe any copyrights. The software for operating the board must be obtained elsewhere as we do not have it for sale. When we say 100% we mean it.
A very good buy at **$49.95**
Custom IC set(2) **$49.95**
Keyboard encoder (AY3-3600) **$14.95**
Character generator, U/LC **$14.95**

IIe® ABS PLASTIC CASE
$49.95

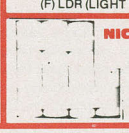


This case is made to fit the Mother Board listed here for making IIe® clones and it makes a very nice looking copy. There is just enough difference to avoid design infringement. The case also has no brand names or other marks on it.
A good buy at **$49.95**

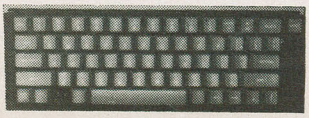
IBM POWER SUPPLY



One of the nicest open frame IBM type switching power supplies we have ever seen. Came from the defunct NCR IBM compatible. runs the whole thing, has +5V-7A, +12V-3A, -5, -12-¼A. A very good unit for starter system. Will not run hard disc system. A real Steal at **$49.95**



NICADS 8.4V 7 "D" 4A.H CELLS
A great buy, a pack of 7 brand new GE NICADS giving 8.4v at 4 Amp hours. Each cell is 1.2v and separates easy. Used as 5V backup through a 7805. Gives 5v 1 Amp for 4 hours **$14.95**



IIe® MATRIX KEYBOARD
$69.95

This keyboard fits the above case and has 100% clone compatibility, it will allow operation of all IIe® commands. Another bargain at **$79.95**

SWITCHING POWER SUPPLY

Another great bargain from PARTS GALORE, A small power supply switching style that give +5v – 4A; ±12v 1A and –5v (adjustable) on a compact 4x8" open frame PCB. Cost Northern Telecom $50.00 when they bought 5000 pieces. We got em when a subcontractor went belly up for 10% of that price and we are selling em for

$18.95 NEW IN BOX TESTED

AC power cable (3 Wire) for above **$2.50**

COMPUTER PARTS GALORE INC.
316 College St.
Toronto, Ontario M5T 1S3

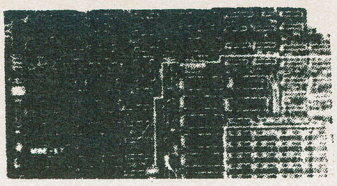
Toll Free Orders Only
1-800-387-1385
Order Checking (416)925-8291
Technical Data (416)925-1105

MAIL ORDERS: We accept VISA; MC; AMEX; credit cards. Money orders, cheques (2 week wait) are also OK. Minimum packing and handling fee $5.00 or 5%, whichever is larger. The only COD we use is via CANPAR (Add $4.00 COD fee) or motor freight. We do not use postal COD at all. All Ont. res. add 7%. All prices are subject to change without notice. Returns are subject to a 20% restocking charge.

CHERRY IBM™ $99.00 STYLE KEYBOARD

At last a good low cost keyboard for the IBM PC, XT or compatible machine. Uses capacitive keys, has a very good feel", and has TYPEWRITER LAYOUT for easy word-processing at the very low price of **$99.00**

MBE-XT
AN IBM® XT Compatible 8 Slot Motherboard



MBE-XT BARE PCB WITH MANUAL AND SCHEMATICS.
$49.95

LAZY BOARD

What is your time worth?? We have had a bunch of MBE-XT boards stuffed and wave soldered so you can save all that time soldering them up. All you need are the IC's memory and BIOS and you are set to go **149.00**

FULLY WIRED AND TESTED WITH 64K ON BOARD WITH MEGABIOS AND MANUAL
$365.00

- 8088 16 Bit Microprocessor
- 8087 Math Processor. Optional
- Up to 256K Dram on Board
- Has Digital Delay Line for Error Free Memory Refresh
- 8 IBM Compatible Expansion Slots
- 4 DMA and Timer Channels
- 64K/128K Eproms Jumper Selectable
- Will run any Compatible BASIC
- IBM Power Plug Compatible
- Same PCB size as IBM XT
- Runs PC-DOS and CPM-86
- Compatible BIOS in stock

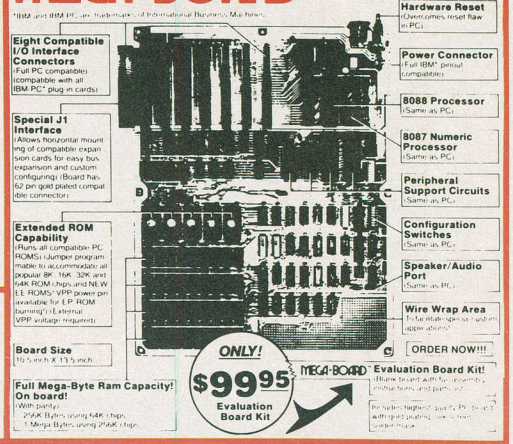
MEGA BIOS

The amazing MEGABIOS® from DTC of Dallas. A fully rewritten BIOS that allows you to make a fully compatible legal system. Note they do not ask MEGABUCKS® for it, only ... **$29.95**

TAIWAN BIOS, not as good or 100% compatible but it will get you running and save you bucks **$19.95**

TAIWAN BASIC, in 4 2764 EPROMS **$49.95**

DTC DISPLAY TELECOMMUNICATIONS CORPORATION — MEGA-BOARD new!



ONLY! **$99.95** Evaluation Board Kit

IBM BARE PCB

(A) Color Graphics (Persyst)	$27.95
(B) Monochrome graphics	$24.95
(C) Disc controller	$17.95
(D) Disc controller + Printer	$24.95
(E) Disc controller + Game	$24.95
(F) IO + 2 I/O clock etc.	$24.95
(G) Multifunction card 11 function	$24.95
(H) AST SIXPACK COPY	$34.95
(I) Parallel printer	$17.95
(J) RS-232 card	$17.95
(K) Simple modem card	$17.95
(L) Disc for above	$ 8.00
(M) 512K card	$24.95
(N) 256K short card	$19.95
(O) IBM 6" extender for service	$19.95
(P) WW Proto, full sized with DB-9 & DB25 footprint	$24.95
(Q) WW Memory proto, full sized with 256K (1Meg) memory laid out on one end with DB-9, DB25 footprint	$29.95
(R) 512K Mapping PROM	$12.95
(S) Multifunction PROMS(2)	$24.95
(T) 2732 for color graphic	$10.00

All cards come with a detailed parts list and placement drawing, we also have all parts needed for them.

MBE-XT

MBE-XT Motherboard, wave soldered with no IC's at all with manual and schematics **$149.00**

As above with 64K, BIOS, tested with all IC's and fully burned in, 8 Slots **$325.00**

BASIC SYSTEM, MBE-XT, A & T with 256K with one 360K drive & controller with power supply, hinged lid case and MEGA-BIOS **$895.00**

MBE-XT SYSTEM +, The fully loaded MBE-XT system with 256K on board, BIOS, Cherry keyboard, color graphics, 2-360K DSDD Drives with controller and serial, parallel ports, calendar, clock and many more small features, fully tested, ready to go **$1395.00**

MEGABOARD

MEGABOARD Motherboard, Wave soldered with no IC's at all with parts list and schematics **$195.00**

MEGABOARD Motherboard, Wave soldered with all IC's and 64K on board, with schematics and test data, no BIOS but fully burned in and tested with one ... **$399.00**

BASIC SYSTEM, MEGABORD, A & T with 256K (256K DRAMS) with one 360K DSDD Drive & controller with power supply and hinged lid case, and megabios **$995.00**

MEGABOARD SYSTEM +. The fully loaded MEGABOARD with 640K on board (256K & 64K DRAM) with 2-360K DSDD drives and controller, color graphics board, with serial, parallel, clock, calendar, and many small features fully tested and ready to go **$1999.00**

IBM CASE

We have the nicest case of all the various competing cases, ask any friend who has bought someone else's case and then has seen ours. The lid is hinged with pushbutton access. The back is cut for 8 XT slots and it comes with all the case back inserts for cards, card guides, blind disc filler plates, standoffs, feet, screws, all for . **$79.95**

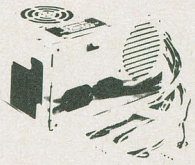
Please specify back or side cutour for power supply.

We also have an IBM 8 Slot/6502 Board dual duty case for making IBM look-a-like 6502 systems **$79.95**

MEGABOARD CASE, similar to the above, but no pushbuttons or hardware, from DTC in Dallas Texas. A stronger US made case, but less finishing parts. Fits the MEGABOARD exactly with side cut extender, for back power supply **$99.00**

SWITCHING POWER SUPPLY

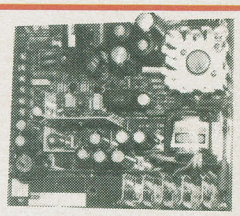
110V, 60Hz with Fan and two rear switched outlets.



These power supplies fit our cases.
100 WATT +5v-10A; + 12v-3.5A; ± 12V-1/2A **$139.00**
130 WATT +5V-14A; + 12v-4.2A; ± 12V-1/2A **$149.00**
Please specify, side or back switch

8" DRIVE SWITCHING POWER SUPPLY

$39.95



The greatest 8" Drive supply we have ever found. Has 24V-2.2A 5V-3A and -12V-.17A. All you need for a dual 8" Drive system. A switching power supply by ASTEC ... **$39.95**

PARTS, PARTS, PARTS, PARTS, PARTS

Hard to get parts for your IBM compatable (8088) systems and peripherals

8088 CPU	$7.95
8087 Math Processor	$219.00
8237A-5 Prog. DMA Cntrl.	$8.95
8250 Serial Port	$9.95
8253A-5 Prog. Interval timer	$5.95
8255A-5 P.I.A.	$4.95
8259A Prog. Interrupt Cntrl.	$4.95
8284A ADC clock gen & driver	$5.95
8288 Bus Controller	$9.95
8272 Floppy Disk Controller	$9.95
NEC 765 Floppy Disk Controller (equivalent to 8272)	$9.95
Set of 8088, 8255A-5, 8237A-5, 8288, 8284, 8253A-5 and 8259A	$55.00
2716	$3.49
2732	$3.95
2764	$4.95

DELAY LINES

100ns delay line	$6.00
7ns delay line	$13.95
62 pin edge con (high quality)	$2.40
5 pin Din conn	$1.25
Power conn	$1.25
Dip switch 8 pos	$2.49
4.7k x 6 sip	$ .69
4.7k x 8 pin sip	$ .69
8.2k or 10k 16 pin Resistor or network	$ .99
33ohm x 8 network	$1.10
Small speaker	$1.99
.1 uf 50V high quality bypass capacitors	$ .10
Trimcap	$ .99
34 pin card edge con. for your floppy controller	$5.95

LS for IBM Systems

00	$0.39
02	$0.39
04	$0.39
08	$0.39
10	$0.45
20	$0.45
27	$0.45
30	$0.45
32	$0.80
74	$0.50
138	$0.70
158	$0.75
175	$0.80
243	$1.20
244	$1.25
245	$1.50
273	$1.50
322A	$6.00
323	$3.50
373	$1.40
374	$1.40
377	$1.25
670	$1.75
7407 TTL	$1.00

S SERIES

S00	$0.75
S02	$0.75
S04	$0.75
S08	$0.75
S74	$0.85
S138	$1.75
S157	$1.85
S158	$1.85
S374	$3.25

MISC

75477	$1.25

Hard to get parts for your 6502 Systems and Apple Compatible Peripherals.

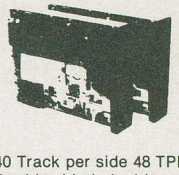
6502 CPU	$ 5.50
6845 CRT controller	$ 9.50
68A45 CRT controller	$ 9.95
Z80A CPU (4 MHz)	$ 4.99
MC3242	$11.95
74LS367	$ .62
74LS259	$ 1.39
74LS161	$ .99
74S74	$ .82
74S174	$ 1.70
74LS323	$ 4.55
Card edge connector (50 pin)	$ 2.49
RCA jack PC mount	$ .69
6 pin power square connector	$ .99
Phono jack (small)	$ .99
MPSA 13 trans	$ .55
2N3904 trans	$ .19
2N3906 trans	$ .27
MPSU51 trans	$ .79
2N4258 transistor or equiv	$ .69
1K SIP 10 pin	$ .69
1K SIP 8 pin	$ .69
10K SIP 10 pin	$ .75
4 pos dip sw	$ .95
20 pin female header for disk drive	$ 1.79
20 pin male	$ 1.69
50 pf trim cap	$ .89
220 ohm trimpot	$ .69
20 conductor ribbon cable	$ .89/ft.

MONOLITHIC CAPS

MONOLITHIC CERAMIC CAPS
We bought 100,000 of em dirt cheap, they are very good quality, 63V, 0.2" lead spacing. Now only **10¢ ea.**
50 pcs. ..... **$ 5.00**
100 pcs. ..... **$ 9.00**
1000 pcs. **$85.00**
more? ask!

WE'VE GOT EM!

5-1/4" HALF SIZE DRIVES! For IBM PC, TI PC, XEROX 820



Shugart/Panasonic ½ size SA455-3AEC **$179.00**

TEAC (A Cadillac Drive) ½ size FD55B **$179.00**

CANON ½ HEIGHT

Canon entered the ½ height drive market with the nicest drive we have seen for a while. Fully IBM compatible. 40 Track. Very quiet. With all hookup data **$149.95**

- 40 Track per side 48 TPI
- Double-sided, double density
- Same as SA455
- Latest head & drive technology
- Fast access time

TEAC

TEAC .....the nicest drive FD55F ..... **$219.00** with free DOS patch for 80 track.

- 80 Track per side 96 TPI
- Double sided, quad density
- Same as SA465
- Latest head & drive technology
- Fast access time

COMPUTER PRESS

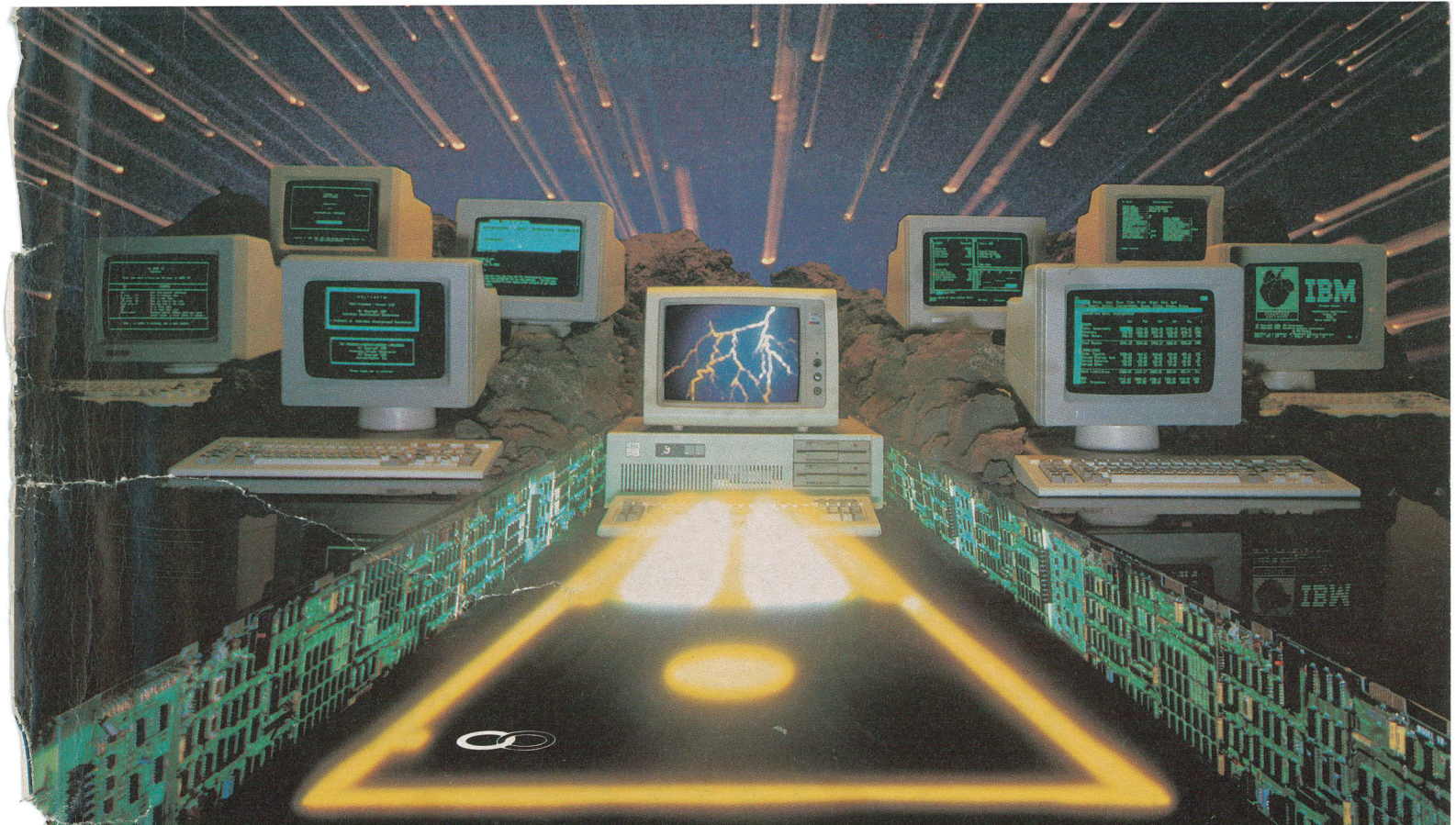
Sharp's **CE-515P** four colour plotter is bundled with Softkey's Keychart software for the IBM, and accepts 8 1/2" wide paper, postcard sized documents or overhead transparencies. Available from authorised Sharp computer dealers, the plotter has a suggested retail price of $495.95...

With supporting software for Apple, Commodore 64 and IBM PC computers, *Info-Ad Systems'* **smart VCR controller** is designed to permit videotape segments and computer generated text to be sequentially combined in a variety of ways. Up to five VCRs can be connected to the controller...

Voice-Link is a speaker-dependent voice recognition system that digitizes spoken words and stores them on disk. Introduced by project Research Group Limited, the system operates with MS-DOS compatible computers, and is being marketed by *Voice-Works Incorporated.* The system is equipped with a standard 128-word memory (expandable to 512 words) and features user-controlled program switching, self contained memory and 4800 baud asynchronous data transmission...

Addresses: Voice-Works ● Incorporated, 74 Alex Avenue, Woodbridge, Ontario L4L 4K6 (416) 851-7751 ● Info-Ad Systems Limited, 915 Fort Street, Suite 370, Victoria British Columbia V8V 3K3 (604) 381-3124 ● Sharp Electronics of Canada Limited, 335 Britannia Road East, Mississauga, Ontario L4Z 1W9 (416) 890-2100 ● TEO Computers and Peripherals Incorporated, 275 Steelcase Road East, Markham, Ontario L3R 1G3 (416) 474-9372.

Computing Now! Advertisers Index



Networking Raised to a Greater Power

Advanced Technology. With it, IBM tripled the speed of the PC and increased its memory capacity five-fold. Nowhere is this increase in computing power more important than in networking situations. If the AT's technological advances have prompted you to look into a multi-user network, you owe it to yourself to take a closer look at MultiLink Advanced™ . . . a unique multi-tasking, multi-user networking system that runs programs under PC-DOS 3.0.

Eight Workstations for the Price of an AT. MultiLink Advanced™ represents the next generation in networking systems for IBM microcomputers. The system enables terminals, connected to a single AT, to emulate IBM-PC's having up to 448K of RAM (The PC-Shadow™ terminal, shown above, even has a PC look-alike, as well as work-alike keyboard and display).

This means that instead of spending $3,000 per workstation for a PC with a Kilobuck "Network Interface Board," you can use inexpensive terminals . . . eight of which cost less than an IBM AT. Even if you need only one workstation connected to your AT, you'll realize significant savings.

MultiLink Advanced™ . . . Instant Access to All of Your Resources. Central to most multi-user situations is the need to coordinate a variety of printers. With what's been described by *PC-Tech Journal* as ". . . by far, the best print spooler for the IBM PC," MultiLink Advanced™ gives users the option to print either at their workstations, or at a central location. In addition, programs and files can be shared by multiple users locally or through use of a modem. Just think of it . . . having remote access to an AT with a lightweight terminal/modem.

Although designed to take advantage of the AT, MultiLink Advanced™ runs on all versions of PC-DOS, except 1.0, and certain implementations of MS-DOS. A wide range of leading programs are supported which include WordStar, dBASE III, Multimate, and Lotus 1-2-3.

Get the Advanced Story Today. Call The Software Link Today for complete details and the dealer nearest you. MultiLink Advanced™ is immediately available at the suggested retail price of $745 and comes with a money-back guarantee. VISA, MC, AMEX accepted.

MultiLink™ ADVANCED

THE SOFTWARE LINK, INC.

400 Esna Park Drive, Suite 18, Toronto (Markham), Ont. L3R 3K2

CALL: 416/477-5480

Dealer Inquiries Invited

Circle No. 18 on Reader Service Card

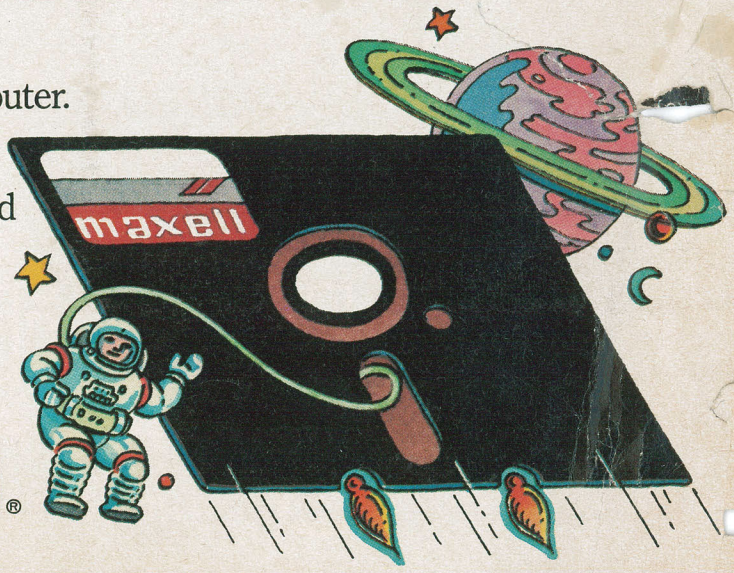
IBM, PC, AT, & PC-DOS are trademarks of IBM Corp. MS-DOS, WordStar, dBASE III, Lotus 1-2-3, and Multimate are trademarks of Microsoft Corp., MicroPro, Ashton-Tate, Lotus Development Corp., & Multimate International, respectively.

MultiLink Advanced™ & PC-Shadow™ are trademarks of The Software Link, Inc.

Maxell Gold.

The floppy disk that packs more facts into Compaq®, sets HP® free, and takes IBM® Portable where it's never gone before.

It's great to have a portable computer. Especially when your data stays put. For error-free performance at home or abroad, trust Maxell. The Gold Standard in floppy disks. There's a Maxell disk for virtually every computer made. Each is backed by a lifetime warranty. Maxell. Accepted everywhere, without reservation.



Griffco
Griffco Marketing Inc.

maxell®
IT'S WORTH IT.

Griffco Marketing Inc., P.O. Box 1218, Station B, Mississauga, Ontario L4Y 3W5 (416) 625-6559

Circle No. 19 on Reader Service Card